The Electrical World.

VOL. XXXII. NEW YORK, OCTOBER 22, 1898. No. 17.

PUBLISHED EVERY SATURDAY BY

THE W. J. JOHNSTON COMPANY,

9 Murray Street, New York.

Telephone Call: Cortlandt 924. Cable Address: "Electrical," New York.

New England Office, 620 Atlantic Ave., Boston.

Western Office, 936 Monadnock Block, Chicago.

Philadelphia Office, 929 Chestnut Street.

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INCANDESCENT LAMPS FOR NIGHT DECORATIONS.

With the constantly increasing facilities for obtaining, wiring and erecting large numbers of incandescent lamps, more and more elaborate signs, arches and other decorations illuminated by hundreds or thousands of lamps each are constructed for temporary use during special celebrations and torn down after a few days' service. Notable among the recent illuminations of this kind were the effects obtained at Cincinnati at the recent Grand Army reunion and at Pittsburg at the more recent conclave of the Knights Templar. An illustrated description of the latter may be found on other pages, and is worthy of careful attention on the part of those who have charge of the work for the various peace jubilees about to take place, in which such effects will be the central feature of the display.

It is remarkable how perfectly the incandescent lamp adapts itself to this service. The desired effect is not intensity of illumination; if it were, the arc light would be more satisfactory than the incandescent, which is, as every one knows, not the case; nor is the effect wanted a perfect distribution of light. Transparencies with the lights concealed behind them and giving a solid illumination are not as satisfactory as the uncovered bulbs. The separate and distinct dots of light, outlining graceful figures, give a mental impression that is half unconsciously expressed by observers of displays of this kind, who speak of them as like a scene from fairyland. It is probable that, as the effect is not one of intensity of illumination but of its division into a large number of distinct points, lamps of a lower candle power would give just as satisfactory an effect with a correspondingly smaller consumption of power; but, as the cost of power is a small feature in this work, the cost of construction being far greater, any saving made in this way would be a small one.

CARBIDE FURNACES.

The development of the electric furnace has been greatly accelerated during the last two years by its practical applications on a large scale, notably to the production of calcium carbide. It has been well said of the electric furnace that it gives mankind a new chemistry. The relative magnitudes of chemical affinities are transposed at the high temperatures obtainable in this manner, and compounds extremely stable at ordinary temperatures are dissociated and others of far smaller heat of combination formed. This gives a means of tearing apart elements that cling to each other with great tenacity and reassociating them into other compounds quite unstable at low temperatures, and hence giving strong chemical reactions even with otherwise inert substances. Notable among such reactions is the production of calcium carbide from lime and carbon. At the temperature of the arc the attraction of the oxygen and the calcium within the lime is overcome by the attraction of carbon for both, resulting in the formation of calcium carbide and carbon monoxide. When reduced to ordinary temperatures the calcium and the carbon of the former have so little attraction for each other that they greedily attack water to form more stable compounds, among them the valuable illuminating gas acetylene.

The problems set before the designer of carbide furnaces are several. First, perhaps, is the difficulty of making the electric arc, or more properly current, as the compound in a carbide furnace is a conductor, leave the path through the smelted product and attack

Engineering Society Library

fresh unheated mixture. This is due to the fact that the liquefied product is a better conductor than the powdered constituents. The arc thus tends to cling to the very path where it is not wanted. Many ingenious devices for overcoming this tendency are described in the article by Mr. F. Jarvis Patten, on another page.

Another problem is the design of a furnace for continuous operation. A limited run on an initial charge necessitates a waste of considerable heat—and electrically developed heat is valuable—every time the furnace is charged in raising and lowering the temperature of the apparatus. The voltage also must be varied during the run, starting very low when the arc is struck by bringing the electrodes together, and means must be provided for switching and controlling the voltage of currents and powers quite difficult to manage. Many continuous furnaces have been devised, but all the difficulties with apparatus fitted to withstand this high temperature are not yet surmounted.

Another important consideration in the design is, of course, the heat insulation of the furnace, for, as noted above, the heat is costly and its tendency to radiate is great, owing to the high temperature. One furnace, designed by Pictet, attempts also a saving by heating the raw material first to as high a temperature as possible by less expensive sources of heat than the electric current, the electric furnace proper raising them then to its own high temperature.

STREET TRACTION WITH SURFACE CONTACTS.

Objections to the overhead trolley on the score of appearances, and to the open conduit on the score of expense, will undoubtedly give a tremendous demand for the first really successful closed conduit or sectional-conductor surface-contact system. Each such system requires a switch for every few yards of track, and the one essential requirement to success not yet fulfilled is the high degree of reliability of this switch. The tendency in this line, as evidenced by Patent Office records and a few practical trials, is toward a switch operated by an electromagnet, and a device of this type, interesting because of its ingenious novelty, is described in a paper read before the British Association by Prof. S. P. Thompson and reprinted on other pages of this issue. Mercury contact is used, and the break is made under oil.

The switch itself seems to have the desired element of simplicity, but the complete arrangement is open to several criticisms. Among them is that which applies to all systems depending for their operation of the electromagnetic switches on current supplied from the power house, which is that, once the car has become disconnected from the source of power for any reason whatever—as an imperfect contact or faulty switch—it is henceforth helpless and cannot operate the next or any switch in advance. The opening of a circuit breaker at the power station would, with such a system, render every car absolutely helpless and unable to get further communication with the live feeder. For this reason any system dependent on electrically operated switches to be worthy of serious consideration must carry on the car a source of current—preferably storage batteries. This also, unless of 500 volts' pressure, necessitates another auxiliary rail or set of contact buttons to conduct the low-voltage current to the switch magnets.

The switch described has an ingenious arrangement for grounding its exposed contact in case it fails to open the circuit when the car leaves it. Unfortunately, this grounding device provides only for the inaction of one of its two moving parts, and in case both fail to restore to the normal position the exposed contact may remain "alive." A better device, which has often been proposed in this country, is a simple grounded contact carried by the car and following at a proper distance the main shoe or skate, this grounded contact absolutely short-circuiting the line through any switch which may fail to open when the car leaves it.

The study of these switches is valuable on the part of electric railway designers, as it is more than probable that, by a combination of the good elements of the many imperfect devices designed, there may soon be attained a switch sufficiently reliable for the successful operation of surface-contact roads.

SPEED VARIATIONS IN ALTERNATING-CURRENT MOTORS.

The control of the speed of alternating-current motors is more difficult than that of direct-current motors, as all types of the former, if designed for high efficiency, must be run with a peripheral velocity approximating synchronism, there being no means of varying this materially and maintaining efficient working by a variation of the impressed or counter e. m. f. as in the direct-current machine. With synchronous motors the speed must absolutely be maintained the same in cycles per second as that of the generators, and the only way of affecting the speed of the motors is to vary that of the generators, a plan sometimes used where one large motor is driven by its own special generator. With induction motors a method of changing the speed in a ratio of two to one, which has often been proposed but never practically used, consists of rearranging the windings by some suitable form of controller, so as to give one-half the number of slots per pole in one controller position that are given in the other. This can be effected, for example, in a motor which, when working at full speed, has four slots per pole per phase, by so rearranging the windings for half speed as to give two slots per pole per phase. This gives one-half the angular velocity of the rotating field with the same frequency, and consequently one-half the speed of the motor. The motor, however, if built for efficient running and a satisfactory economy of material per output for one speed, does not give the same good results as the other. Still another method of getting a speed variation in the same single ratio is that known as the tandem-multiple control, which is applicable to two motors driving the same load, this method calling for a wound secondary on one motor with the same number of turns per phase as the primary, the half speed being obtained by connecting this wound secondary with the primary of the second motor, the alternating-current supply being connected with the primary of the first motor. With the motors running at half speed the wound secondary becomes the source of alternating currents with one-half the frequency of those impressed upon its primary, these alternating currents entering the primary of the second and tending to drive its secondary also at one-half speed, minus the normal slip. This system has been proposed especially for traction work, but a serious difficulty is the extremely low power factor of the current when the motors are running in the tandem position. The magnetizing current is the same as that required for the two motors in parallel, and the energy current is for the same torque—one-half of that required when running with the machines in parallel.

The induction motor is also capable of other and less efficient forms of speed control, that most widely used being the insertion of variable resistances in the secondary, which gives speed, torque and efficiency characteristics closely comparable with those of direct-current shunt machines controlled with armature resistance.

Electrolytic Corrosion of Underground Piping.

According to Professor Fleming, about one ampere week will, theoretically, corrode electrolytically about one cubic inch of iron. In experiments imitating as closely as possible the conditions of underground iron-pipe systems and electric railway returns the actual corrosion was nearly three times this, owing probably to local action.

The Illumination at the Knights Templar Conclave.

PROBABLY the most elaborate and extensive electrical illumination of streets ever attempted was that carried out in Pittsburg at the recent conclave of the Knights Templar, October 11-14. The desire to surpass all previous records, a strong local patriotism and the reputation of Pittsburg as an electrical centre were some of the motives for undertaking this most elaborate display.

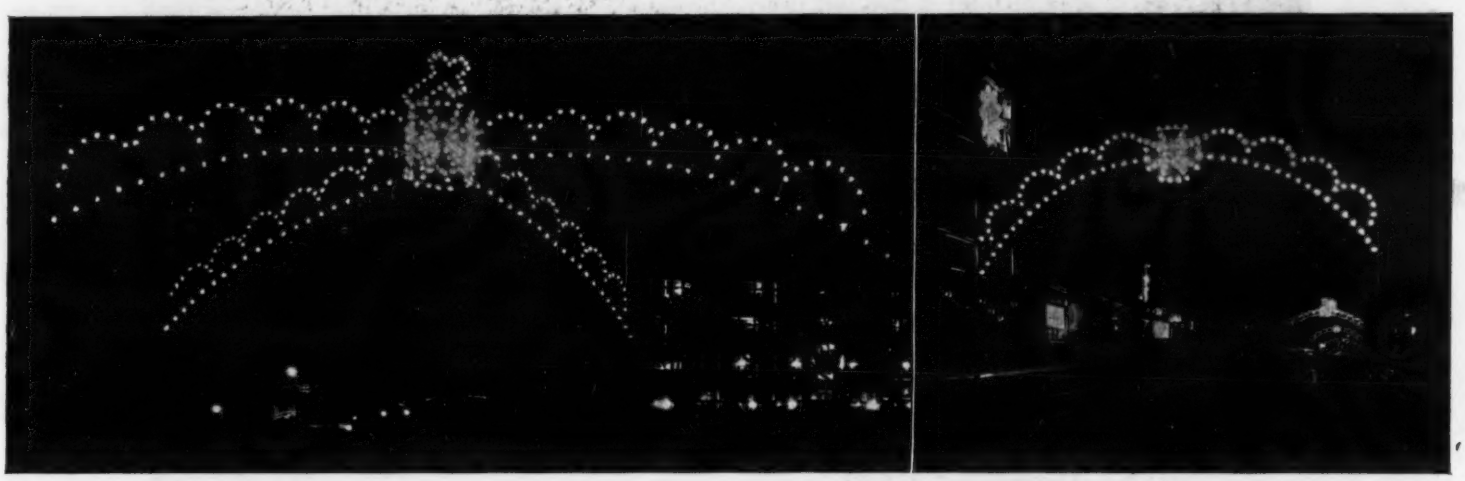
The main feature of the display was a series of metal skeleton arches, twenty-nine in number, spanning Fifth Avenue in Pittsburg, and its extension into Allegheny. These arches were in two general styles, one called the quadruple, of which there were ten, springing from the four curb corners of the street crossings to a common point overhead, and the other, or single style, spanning the street at points between the street corners. These arches are of a strictly temporary character, and will be scrapped as soon as their present service is completed, so that their construction for maximum economy of material and labor was rather an interesting problem. They were made up in general of a single wrought-iron pipe sprung from supporting columns bolted to a base plate on the curb, with small arches or loops, also of iron pipe, and more elaborate figures at the apex. The latter were of frame construction and of four different styles, showing different appropriate symbolic designs, among them the various crosses, shield, crown, etc., of Masonic significance. These centre pieces were on the single arches constructed in one plane, but on the quadruple arches were made up in the form of four similar designs arranged on the four sides of a square, facing the four street directions. The arches were constructed by the Pittsburg Ornamental Iron Works, of Allegheny, the electrical work being done by the Carter Electrical Company, of Pittsburg, and the lamps and current were supplied by the Allegheny County Light Company. The electrical work was simple, the fixtures consisting of porcelain wall receptacles wired to the iron piping or wooden frame and supplied with current through rubber-covered wire. Over 7000 Sawyer-Man 50-volt lamps with Sawyer-Man bases were used in this work.

The arches were built and wired in sections, each consisting of one-half of a single arch, or one-quarter of a quadruple arch, the erection of these sections being quite simply effected by joining them at the top of the arch and mounting the central figure. The work was complicated somewhat by the fact that the arches spanned the trolley wires with only a few feet of clearance. They were heavily guyed to prevent their falling, and gave remarkably little trouble considering the haste and low cost of the construction.

The current, as above stated, was supplied by the large central station of the Allegheny County Light Company, a description of which has previously appeared in these columns.* Each arch was supplied with current by a specially installed transformer, that for quadruple arches being of 375 lights capacity, and for a single arch of 150 lights capacity. The number of lights varied from 125 to 165 on the single arches and from 350 16-cp lamps to 450 of 10 candle power on the quadruple arches. In the downtown district, where the lighting mains are placed underground, the transformers were mounted aloft on wooden poles, either those for supporting the regular arc lights, or, in case these were not available, special poles, the transformers themselves being of the indoor type protected with rubber covers. Besides these arches the same company supplied almost all of the elaborate private display signs, the total additional load due to the conclave being estimated by Superintendent W. J. Hunker at about 3500 horse-power, making the evening peak of the combined arc and incandescent service in the two stations almost 9000 horse-power. The rated engine and generator capacity was sufficient to carry this, but the boilers, which are of the Babcock & Wilcox make, were loaded 50 per cent. above their rating. These boilers are fitted with Roney mechanical stokers, and the fact that there was no apparent crowding or priming, and that a greater load could have been carried, is a good answer to the argument that mechanical stokers reduce the overload capacity of a boiler. It should be stated, however, that one reason for the ease with which these boilers held this load is probably the care taken in cleaning the boilers of the large Twelfth and Etna Street station. Here two men are kept at work continuously, blowing the soot from the tubes, and a regular boiler-cleaning crew is always at work cleaning the water surfaces. Of the eighteen boilers, two are shut down every Saturday night, allowed to cool over Sunday, and cleaned thoroughly from steam-drum to blow-off by the crew during the whole of the following week. Thus the round of the eighteen boilers is made in nine weeks' time.

The most beautiful illuminated piece in the whole display was a triumphal arch erected by the city, spanning Sixth Avenue in front of the building occupied by the Department of Public Safety. This arch was built and wired complete by the Electrical Bureau, the work being under the immediate supervision of Chief Morris W. Mead. The arch, a night view of which appears in the accompanying supplement, was, of course, of wood, the lower part being boarded up and covered with canvas, the upper part being lathed and finished with mortar, the whole being painted white. Handsome appropriate staff decorations and two large paintings of appropriate scenes added to the beauty of the arch by day, while at night it was illuminated by 1685 incandescent lights supplied with current from the isolated plant of the adjacent building. Unfortunately but a poor idea of the beauty of this work can be given in an illustration, as the softness of the illumination and the charm of the various colors cannot be reproduced. The whole suggested the advisability of fitting permanent marble arches of this type with illuminating equipments for use either on special occasions or regularly.

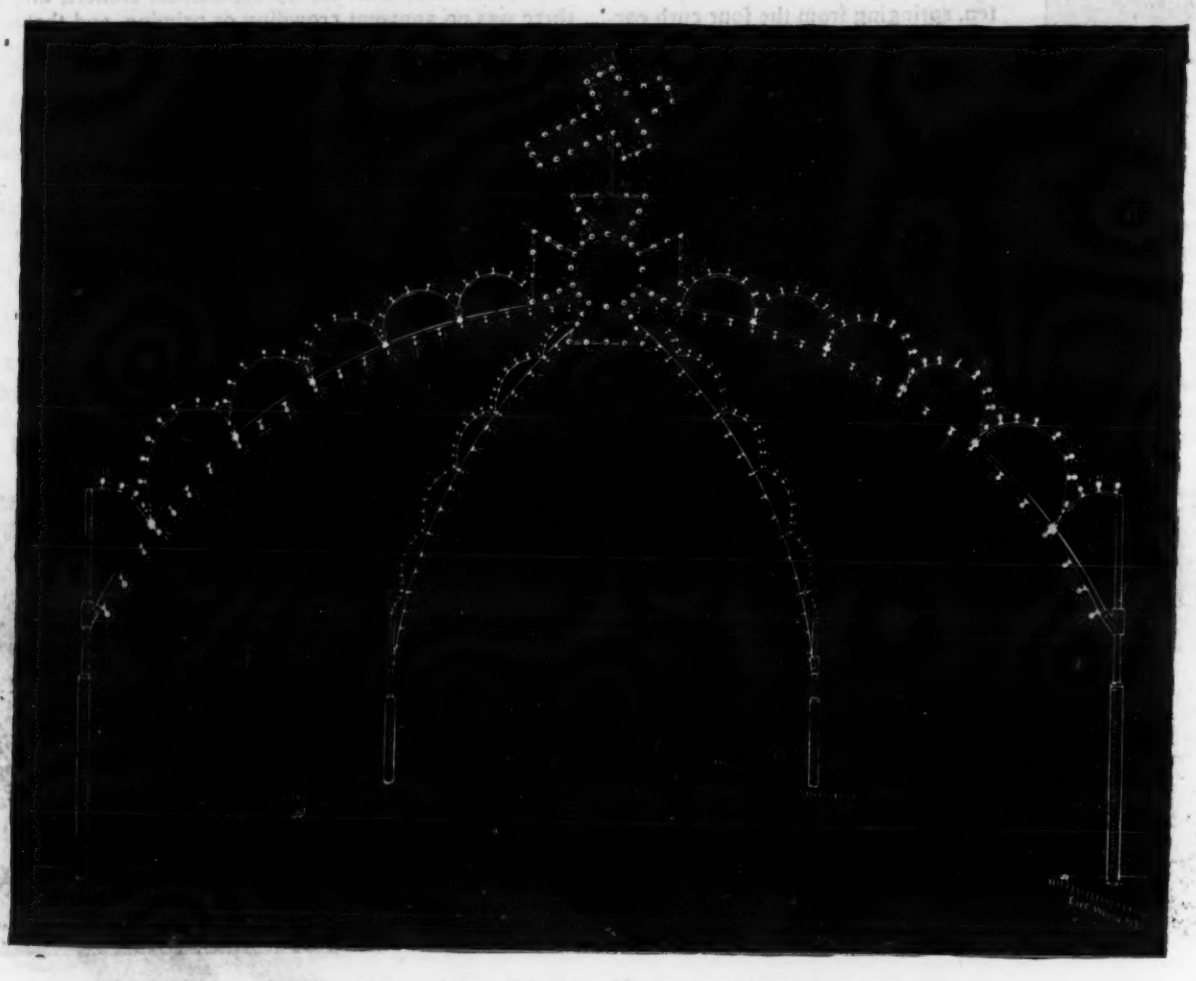
The streets of Pittsburg were a blaze of electrical signs, largely of appropriate symbolic figures, of which the largest, and perhaps the



PHOTOGRAPHIC REPRODUCTION OF QUADRUPLE AND SINGLE ARCHES.

*See THE ELECTRICAL WORLD of November 20, 1897.

largest single-set piece ever constructed, was a mammoth Christian cross on the tower of the court house. This great cross, which is shown in one of the supplemental illustrations, and also in the initial heading this article, was 110 feet in height by 60 feet in width over all, the trunk and arms being 12 feet wide and the whole illuminated with 300 incandescent lamps. The construction and erection, high in air, of this great piece was carried out by Mr. John H. Dorrington, a contracting electrical engineer of Pittsburg. The framework of the cross was 3 by 4-inch angle iron, and as the whole weighed over 10 tons it was put up in sections each 25 feet in length. The background of the figure was of wooden flooring bolted to the angle iron frame, painted red, with letters painted white. The cross was outlined with a double row of 688 red lamps and the letters were illuminated with about 2300 frosted white lamps. All the lamps of this great sign, as well as of the triumphal arch, and many of the electrical signs put up by private parties, were made by the Shelby Electric Company. Many other signs, with interesting variations from conventional practice, were to be seen all over the city, some interesting ones being waving flags, a knight on horseback revolving on a vertical pivot, interior figures made of miniature lamps and buried in palms, circles of lamps under fountain sprays, etc.



Quadruple Arch, Showing Method of Construction.

The Automobile in Flemish.

The London "Electrical Engineer" states that the Flemish Academy at Antwerp has suggested as the correct equivalent of the term "automobile" the following: "Snelpaardelooszonderspoorwegpetroolrituig." It is a fair presumption that this is a complete description of the apparatus which bears the name, although it is not apparent to English readers that the name of either motive power, electricity or gasoline has been incorporated. This important part of the mechanism should certainly not be slighted.

Train Lighting in Germany.

There are now about 1400 railroad cars used by the German Government in the postal service which are lighted electrically.

An Instrument for Synchronizing Alternators.

BY CHAS. A. PERKINS.

There is an optical device, called the cyclostat, not unknown in laboratories, which seems to be specially adapted for synchronizing alternators under the circumstances described by Mr. E. P. Burch in The Electrical World of October 8.

When any rotating machine is viewed through a right-angled prism the machine seems to stand still, provided the prism rotates half as fast as the machine, and in the same direction.

I have made an apparatus on this principle for reading the graduated circle of a transmission dynamometer, to avoid the levers and cams by which the torque of a spring is usually transmitted to a pointer which is at rest. To secure the rotation of the prism I have placed it in a tube, which acts also as the shaft of a gear wheel. This wheel is geared to another of one-half the number of teeth, which is driven by a flexible shaft connected with the dynamometer.

In case it were to be used to synchronize an alternator, either of the machines would be connected to the prism, mechanically or by a synchronous motor, so that the prism should run one-half as fast as the machine with which it is connected. It is then to be placed with the axis of rotation and the longer side of the prism in exact line with the axis of rotation of the machine to be viewed. When this machine seems to stand still, the machines are synchronous, and the phase can also be observed by seeing where the axle seems to be standing, if some point or mark on this axle has previously been observed when the machines were running together in phase.

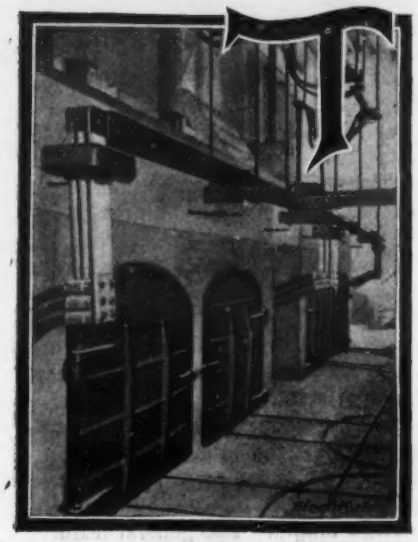
I have not used my apparatus for this purpose, but it seems well adapted to it. Certainly some such device is to be preferred to the hit or miss method often employed.

Inspector of Motor Cars.

The City of Paris has recently appointed an inspector of motor car traffic, a newly created position, the competitors for which must pass an examination. To this office-holder the city pays the munificent salary of $600 per year, or about $12 per week, with an allowance of $100 per year for traveling expenses.

The Electric Furnace.

BY LIEUT. F. JARVIS PATTEN.



THE highest temperature known to science in terrestrial processes is that of the electric arc, and it corresponds closely to that degree of heat required to volatilize carbon, and may be expressed as somewhere about 6000° Fahrenheit. We can easily imagine therefore that early after the discovery and first use of this extraordinary degree of heat all electrochemical processes requiring excessively high temperatures were immediately the field of renewed activity, scientists knowing very well that many of the unsolved problems remained so only by reason of the fact that the requisite degrees of heat for their operation could not be obtained by known methods.

Hence the immediate raison d'être of the electric furnace, which, even with recent developments and improvements, is little else today than an electric arc light built and applied on an extended scale for purposes of heating and smelting refractory substances instead of for lighting space. Most of the mechanism of the electric furnace, as operated to-day, is directed to the work of getting the material to be treated into the electric arc or flame space and keeping it there, and is almost entirely auxiliary to the arc itself and its action. In fact the electric furnace may even now be described as perhaps the most crude and certainly the least developed of recent applications of electricity to the arts, and this fact doubtless explains the present activity in this line. Though twenty years old modern types of furnace differ hardly at all in principle and not in any marked degree in detail from the earliest forms.

Historically, this device dates from the seventies and, like most all simple and fundamental electric machines, it originated, or was first put into practical use, in Europe. The first patent of record describing such an apparatus that I have been able to find bears the name of Charles William Siemens and is dated 1879. The simplest form of furnace including all actually essential features is shown in Fig. 1, which depicts a good form of furnace for laboratory work. There are two carbon electrodes or pencils, *K* and *K'*, the one in the base of the furnace being fixed, the other being movable vertically to determine the length of the arc. The furnace part is made of two blocks of carbon, one superposed upon the other as a base, the top one being removed when the process of fusion is completed. A tube, *S*, permits feeding to the arc the material to be operated on, and a vent, *G*, allows the useless gases to escape.

It is but a step from this simple form of furnace to that shown in Fig. 2, which is the earlier form of the Willson and other American electric furnaces. In this type a fixed block of carbon, *G*, is placed at the base of the furnace chamber and forms the lower electrode, a movable carbon pencil, which may be 8 or 10 inches in diameter, being the upper movable electrode. A tuyere pipe, *E*, allows the products of fusion to be withdrawn when in a fluid state.

Before referring to the improved developments of these simple forms it may be of interest to describe two of the earlier historical forms, interesting chiefly by reason of the celebrated names in applied electrical science that they bear. That illustrated in Fig. 3 is the early Siemens furnace alluded to above. It is more strictly speaking an electric crucible, having horizontal electrodes projecting inward through its sides, both being laterally movable on a system of rollers and carrying between them the arc by which the contents of the crucible are heated. The following excerpt from the Siemens specifications of 1879 shows all the essential features of the electric furnace of to-day:

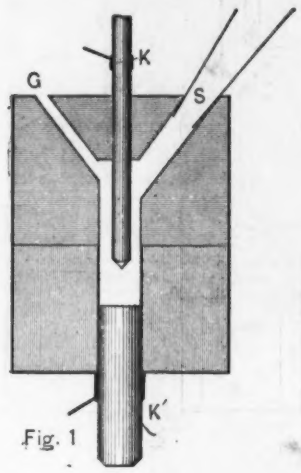


Fig. 1

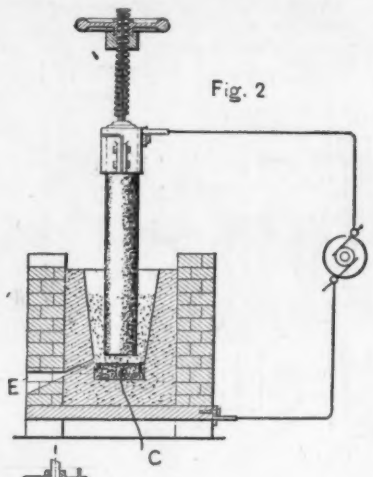


Fig. 2

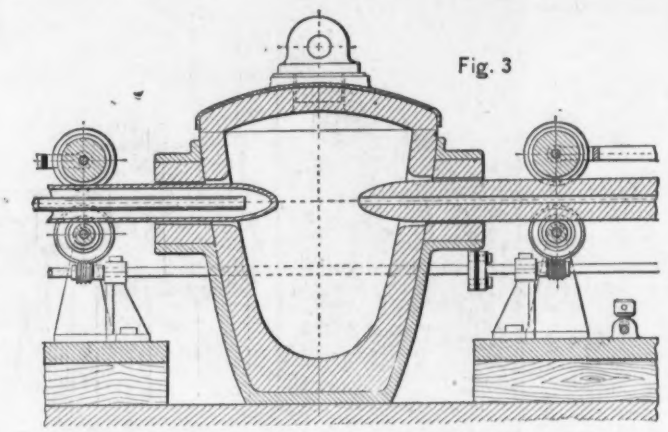


Fig. 3

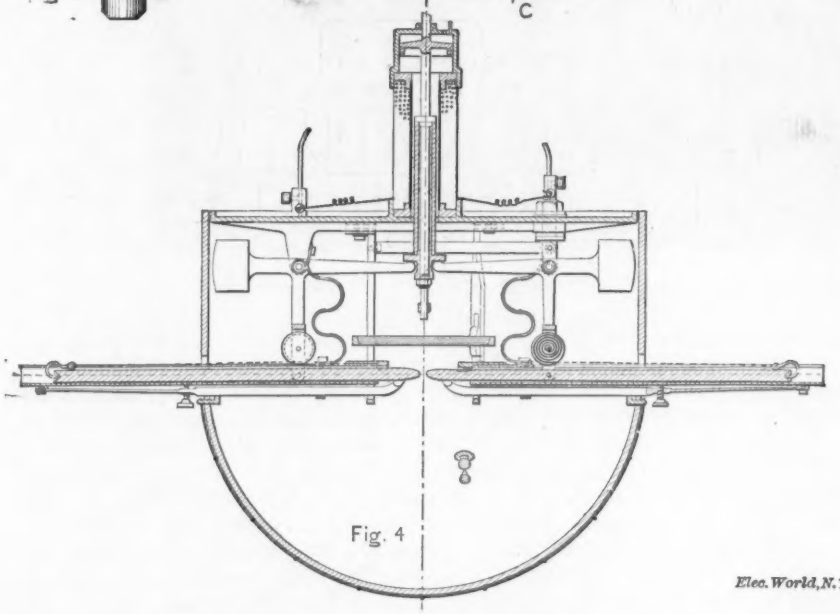


Fig. 4

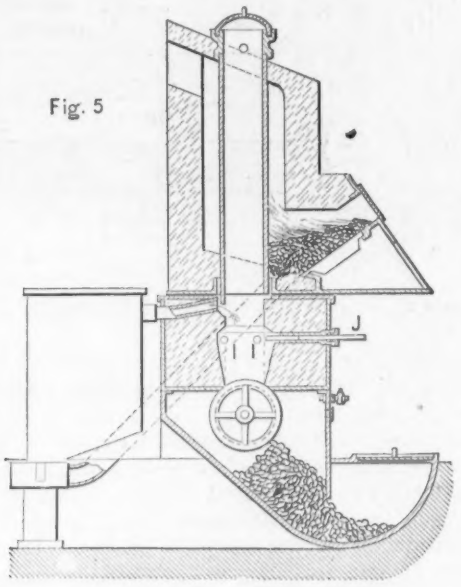


Fig. 5

Elec. World, N. Y.

"In applying the electric current to the production of intense heat for the fusion of refractory substances I employ two carbon rods fitted to slide toward each other horizontally through opposite sides of a crucible made of highly refractory material, such as lime or alumina, a water jacket or casing being used for cooling if necessary. The carbons are movable on rollers, and are operated by clockwork to hold them at a suitable distance from each other for the proper maintenance of the arc."

Fig. 4 represents another modification of the Siemens furnace, with more detail in the regulating mechanism of the electrodes. The other furnace of historical note is that shown in Fig. 5, and is from an English patent granted in 1882 to Camille A. Faure, of storage battery fame, and is described by him as a furnace designed for smelting iron ores. A number of electrodes, *J*, project radially into the centre of the furnace through holes *I I*, and through the arcs maintained between them the material to be treated is caused to pass. There is no evidence that this system of furnace ever came into general use, and the confessed disclaimer of its general utility appears to be sufficient evidence that its author had little idea of the many useful applications of the electric arc furnace in extreme high temperature work, as he describes it only as suited for smelting iron ores and the like. It seems, in fact, that the electric furnace did not receive the serious attention of scientific inventors until it became known in comparatively recent years that such refractory materials as lime and carbon could be readily fused by its intense heat.

The possibility of making calcium carbide on a commercial scale by electrically fusing its two only ingredients, lime and carbon, gave an immense stimulus to this field of research and investigation, and we may soon look for a new-born engine of science destined to accomplish marvels by the simple application of the highest possible temperatures to chemical reaction. Through a wide range of temperature carbon's strongest affinity is for oxygen, but at the temperature of the electric arc a greater part of the carbon in a mixture of lime and coke unites with the calcium of the lime to form calcium carbide ($Ca\ C_2$), a small portion only uniting with the oxygen present to form carbon monoxide (CO) which burns with a blue flame at the top of the charge to CO_2 or carbon dioxide. The reaction is as follows:

$$CaO + 3\ C = Ca\ C_2 + CO.$$

Lime + carbon = carbide + carbon monoxide.

The electric furnace indeed holds out much promise for the future and may prove a veritable storehouse of surprises for both the scientific and the commercial world. Moissan has indeed made artificial diamonds by its aid. Though not as yet commercial articles there is no sound reason why electric furnaces may not become so at an early day.

Before passing to a description of some interesting variations in methods of controlling the arc it may be well to refer briefly in passing to the celebrated Willson furnace at Spray, N. C., which was the first to produce carbide in commercial quantities. It is shown in Fig. 6 and is plainly little else than the general plan of Fig. 2 built on a more extensive scale. This furnace had electrodes of rectangular cross section, about 10 or 12 inches, and the output of a single run was a nugget of a carbide about 3 feet high, weighing over 200 pounds. The first electric furnaces at Niagara turning out nuggets of about 800 pounds differed in no essential particular from that erected at Spray, except in size and output. More recent developments have, however, introduced a number of innovations, and the tendency is constantly to increase the size and output. More recent furnaces at the Niagara plant are built as 1000-hp units, and are designed to produce a nugget of a thousand pounds or more at a single operation. These stacks are about 30 feet high and are built on the general lines of Figs. 7 and 8, the latter differing mainly in the system of feeding the material into the arc by the worm screws, *K K*, at the base of the hoppers, *J J*. Fig. 7 shows a multiple arc furnace designed for a large output. The general features of this furnace are almost self-evident. The heavy rods, 5 5, etc., are the movable vertical electrodes actuated by the hand screws, 20 20, etc. The base plate of the furnace forms a common opposite electrode to all the movable ones. The product of the operation flows into the receiving kettle, 10, the gases escaping through flue 17 to the chimney.

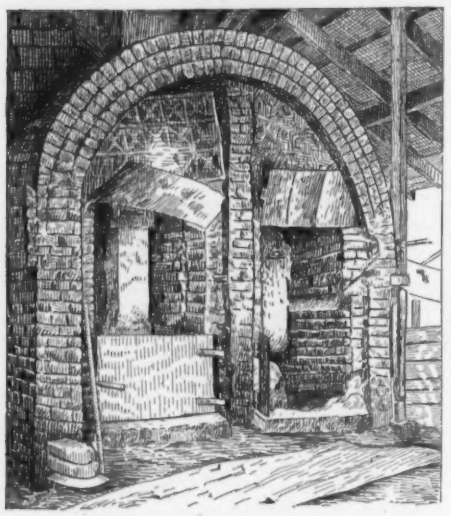


Fig. 6

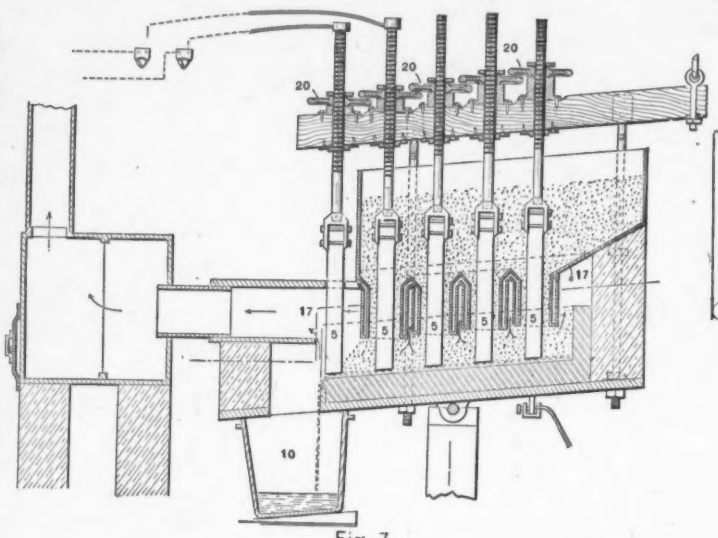


Fig. 7

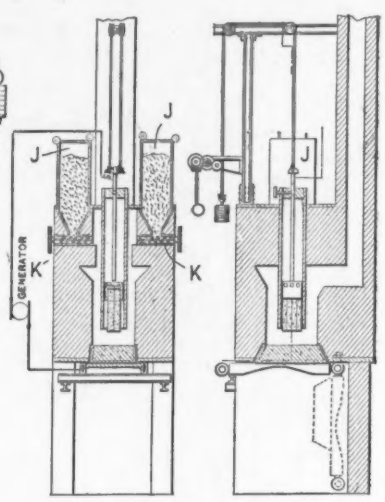


Fig. 8

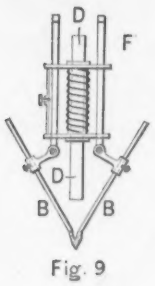


Fig. 9

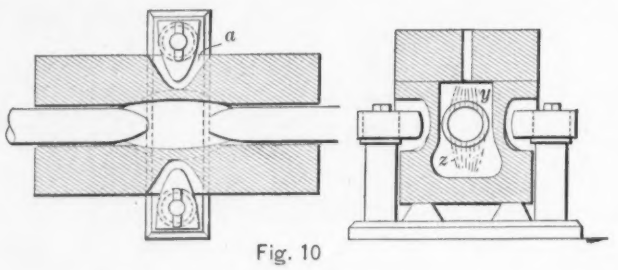


Fig. 10

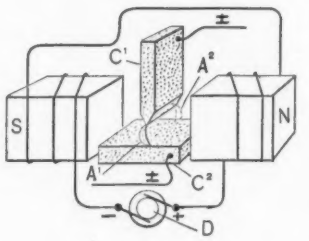


Fig. 11

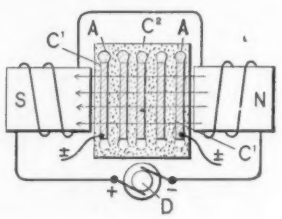


Fig. 12

Elec. World, N.Y.

Quite early in the development of the electric furnace are found attempts of a highly ingenious sort to control the action and motion of the arc. It was long before known that when placed in a magnetic field the electric arc would take up a certain position depending upon the magnetic direction of the field and the direction of the current producing the arc. The earliest intimation of this system that I find is illustrated in Fig. 9, which is taken from an old German patent granted to Dr. Zerener, of Berlin, and is styled by him an electric arc blowpipe, and, though far from being a furnace, it contains the elements of later forms. A strong magnet, *D*, has one pole placed near the points of the two electrodes, *B B*, between which the arc is sprung and the magnetism has the effect of driving the arc out, as shown in the figure in the form of a pointed flame, evidently well adapted in this form to blowpipe use. Not long after the date of this published description of an electric-arm blowpipe I find the same identical principle applied to a fur-

nace proper, and this also in a German patent, dated as early as 1877, and granted to three Englishmen, Rogerson, Statter and Stevenson, who, as pioneers of an original system, certainly deserve passing mention here. Two views of this furnace are given in Fig. 10, and represent the first actual furnace in which the position of the arc is defined and fixed by enclosing the arcing space in a magnetic field, either fixed or movable. This brings me to a description of two furnace systems, with moving electric arcs, which are the invention of the writer and are in extension of the principle applied in the furnace just described, in which the arc was held rigidly fixed in space by a constant and unchanging magnetic field. The system is plainly indicated by the diagrams in Figs. 11, 12 and 13.

In view of the fact that the idea of using a magnetic field for determining and fixing the position of the arc is so old it seems indeed strange that the same agency should not have been long ago applied to move the arc about from place to place or give it a reciprocating or even rotary motion.

The three figures, 11, 12 and 13, illustrate the operation of the reciprocating or sliding arc furnace system. In Fig. 11 C^1 represents an upright carbon slab placed at arcing distance from the horizontal slab C^2, and N and S are the poles of an electromagnet embracing the arcing space. Supposing the lines of force to flow from N to S, the arc between the carbons will assume a position depending upon the direction of current flow. If it flows from the upper to the lower carbon it will take up the position, A^1, at the left hand corner of the upright slab when looking from N to S and remain there as long as the magnetism and the direction of the current are unchanged. If either of these, however, be reversed in direction the arc will immediately pass over to the other corner of the upright slab and remain at A^2. In these physical conditions therefore lies the possibility of a moving arc system, for if either the magnetism or the current be slowly reversed the arc will see-saw back and forth across the lower edge of the upper carbon and so be constantly moving to and fro. Fig. 12 shows a number of slabs similarly arranged with respect to a common lower electrode. Now in such an arrangement it is evidently a simple matter, by causing the current to flow upward in one vertical slab and downward in the next, to have, upon reversing the field magnetism, adjacent arcs moving to and fro simultaneously in opposite directions. Fig. 13 shows the general features of a furnace constructed on this principle. It requires no special description, being simply a plain application of the principles just elucidated except perhaps to state that there is provided a current reverser or pole changer, Fig. 13a, the purpose of which is to very slowly reverse the magnetizing current and magnetism of the magnet built into the body of the furnace and so cause the several arcs between the upper electrodes and the lower one to slowly oscillate back and forth through the material to be fused as its passes down the inclined floor of the furnace.

It is a simple matter to pass from the preceding to the rotary or revolving arc systems, illustrated in Figs. 14, 15 and 16, in which a ring magnet, with a rotary field, induced by a multiphase current excitation, is built into the furnace in such a way as to embrace the arcing space. Under these conditions the arc between the electrodes is forced to move in a circle around the carbon in its endeavor to keep out of the revolving magnetic field. Various methods of applying this principle are almost self-evident. Fig. 16, for instance, shows a tubular electrode in juxtaposition to a horizontal lower electrode. In this case the revolving magnetic field forces the arc to travel around the circular lower edge of the tube while the material to be treated may be fed downward through the centre of the tubular electrode. The broad principle here described is equally applicable to incandescent furnace systems in which there is no arc whatever to rotate. Such a general system is illustrated in Fig. 17. A slender pencil of carbon, F, passing through the middle of the mixture to be fused, connects the two electrodes. When raised to the fusion point it develops sufficient heat to fuse the surrounding mixture, but this once accomplished the current prefers this path, the resistance of the fused mixture being much less than that of the unfused and untreated portion. The current in such a furnace may, however, be forced to leave the direct path and take up a curved one through the unfused and untreated mixture by surrounding the current space by a ring magnet having a rotating magnetic field as before. This may therefore be styled a rotary current system in which the electric current, following the same law as the arc, is caused to revolve in its constant attempt to keep out of the slowly rotating magnetic field. See Fig. 18.

It seems strange that with such simple means at hand for rotat-

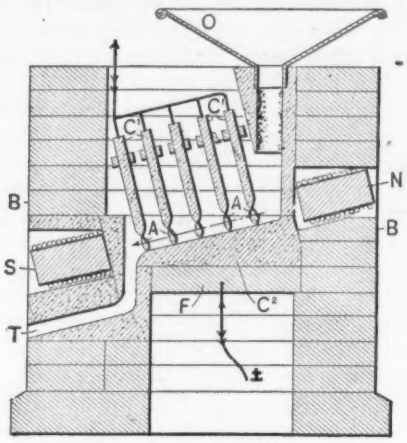


Fig. 13

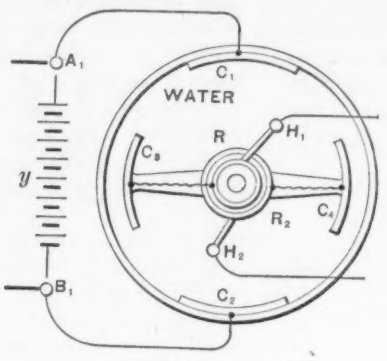


Fig. 13 a

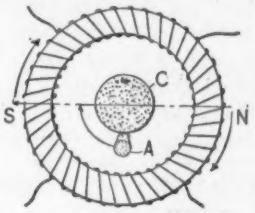


Fig. 14

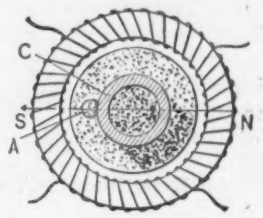


Fig. 15

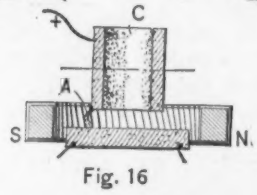


Fig. 16

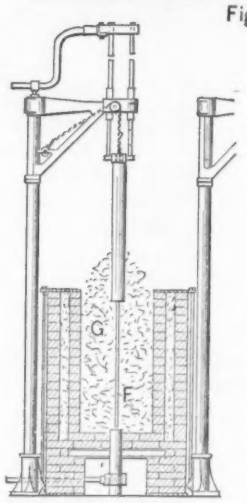


Fig. 17

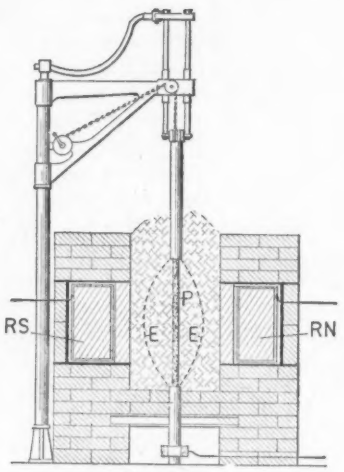


Fig. 18

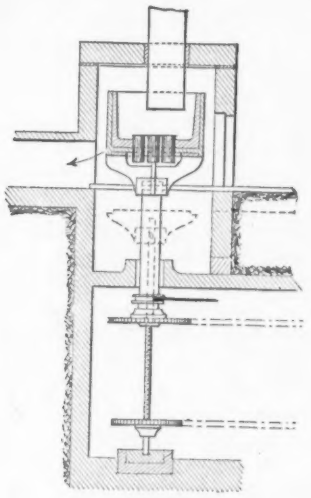


Fig. 19

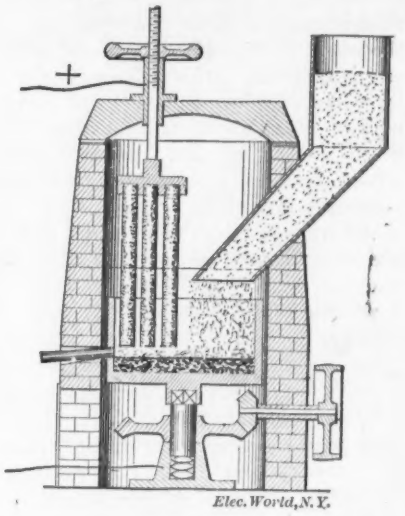


Fig. 20

ing, or traversing the arc without the use of any mechanism or machinery in the furnace that mechanical devices should be resorted to for accomplishing this object and shows quite plainly that early improvements of the electric furnace will of necessity be in the direction of some form or type of a moving arc system.

Fig. 19 shows the general plan of a French furnace recently patented, in which the electrodes are movable with respect to each other, one being kept in motion by machinery during the operation so that the arc will be constantly brought into contact with fresh material. Fig. 20 shows a somewhat similar system from an American patent, in which the lower plate or electrode, built in the form of a circular table, is caused to move eccentrically with respect to a bundle of upper electrodes, the latter being simultaneously revolved about a vertical axis of revolution. This gives considerable latitude to the motion of the arc, but seems unnecessarily complicated and involved, in view of the fact that the arcs can be moved without the aid of any machinery whatever.

A great variety of other furnaces could be given, as illustrations of the already extensive development of the art, but they do not involve any new principle and only serve to show how every variation of detail is seized upon in the attempt to get something new. It may be stated briefly in closing that multipolar furnaces using multiphase currents are among the latest developments in Europe, but have not as yet given marked evidence of any particular advantage. So-called continuous process systems that do not require recharging are much vaunted and talked about of late, but none has come to my attention among a large number that has met the expectations of its friends, and there are few that ever worked in practice at all.

An Experimental Two-Wire 220-Volt Lighting System.

BY DR. LOUIS E. FOULKS, SUPT.

This plant is located in the country town of New Egypt, N. J., lighting its streets and business buildings. Power is obtained from the rather unusual combination of a water wheel and gasoline engine.

The engine and dynamo room is located under and a little to one side of a large flour mill, the room being kept free from dampness by cement floor and walls. A 40-foot shaft, connecting with the water wheel, enters the room through the wall at the lower end, and is belted to a C & C multipolar ironclad generator. The water wheel (50 horse-power) not being sufficient to carry our load, a 30-hp Brighton gasoline engine is used to help it out. A friction clutch pulley is used to throw the engine on and off the water-wheel shaft, as the load becomes heavy in the early part of the evening and light later on.

We frequently, to save water, as the supply is limited, throw off the water wheel late at night, when only the street lights are on, and run them with the engine alone. I would say right here that, if all gasoline engines work as well as ours, it is strange that more of them are not used. When run alone it never gives a variation of more than four volts, or 2 per cent., and when with the water wheel not more than one or two volts. This variation does not show in the lamps. The switchboard, made by Eyanson & Armpriester, is of polished and enameled slate, and contains the usual instruments, being arranged for four feeders. Up to January, 1898, a 110-volt system was in use, lighting only the stores and a few private houses; but, on account of the variation in voltage when a number of lights were turned on or off, it was not satisfactory to the people. At that time the town committee decided that if the company would guarantee to furnish a strictly steady and generally satisfactory light it should be given a contract to light the streets with about 200 incandescent lamps of 20 and 32 candle power.

The distance to which the street lines would have to be carried being a total of 16,287 feet, and as the various plants near here using the 110-volt system were not satisfactory on account of unsteady light and heavy drop on long street lines, the writer decided that the 220-volt two-wire system, using 220-volt lamps, was the only way to solve the problem, and it has done so even better than was expected.

As the company was to receive pay only for such nights as the street lamps were lit, with deduction for any that were out for more than two hours, the streets were arranged in three circuits, starting from the switchboard. This gave prompt and perfect control in case of trouble, as we could at once cut out any defective line and at the same time more easily locate faults. This plan has thus far saved much time, as well as money. The lines are laid out on the feed and main plan, with a calculated drop to the end of each line of 8 volts at full load.

The inside wiring in all buildings is the same as if for 110 volts, using the closed-loop plan to insure even potential. Nothing larger than No. 12 wire has been used, most of it being No. 14. All fittings are the same as for 110 volts. Sawyer-Man 5 and 10 ampere cut-outs, with double-pole baby knife switches, are used. Out of the many makes of wall switches we have tested the Hartford snap switch is the only one found that would stand the voltage, the other makes arcing if double-pole and jumping the break if single-pole, when used to turn off more than six to eight lamps. I have found that in fusing cut-outs and ceiling rosettes it is best to raise the fuse wire free from any contact with the porcelain, otherwise the fuse will blow very slowly and damage the fitting. (This is doubtless due to moisture condensing on the porcelain). We had one mica-covered branch block, fused with 5-ampere fuse wire, so badly burned that it fell apart. This led me to make some experiments, when I found that by placing the fuse so that it would lie on the porcelain from post to post the same disastrous result would be obtained almost every time, while with other conditions the same, but keeping the fuse free from contact with the porcelain, it would blow instantly and do no damage at all. More care is required in wiring and fitting than for 110 volts, but when once done the work gives far less trouble. Extreme care should be given to all joints in wiring, otherwise prompt trouble will ensue.

Lamps at first gave us the most trouble, short-circuiting almost as fast as we could put them on. This was simply the fault of the lamp, so we obtained a supply of various other makes, the result being that we now use only the new-type Edison as made by the General Electric Company, and find them to be the best in respect to long life, candle power and economy, taking about 3¼ watts per candle. The filament in these lamps is short and heavy, and we have had them in all possible positions without any effect on the shape of the filament. All of the Edison lamps have now been burning over 700 hours, and show a remarkably small per cent. loss of candle power. Not a single lamp out of over 200 has blown and only one out of that number has burned out, while, on the other hand, of the makes we first put up very few are now left, and those that are left are, to say the least, very dim. We found from the first that lamps with long, thin filaments were worthless, as the filament soon drooped and cracked the globe.

We have also found that out of four makes of lamps the Edison is the only one that will stand any excess voltage. There are four pilot lamps on our switchboard, and when we first started on 220 volts we put in four different makes of lamps. As the switchboard voltage is 226 volts, at the end of two weeks only one of the original lamps was alive, that being an Edison. The same lamp is yet there, with a record of over 1000 hours at 226 volts. Our experience with lamps has brought out the fact that their inferior quality is more quickly developed in the 20 and 32 cp sizes than in the 16. This is just the reverse of what I have been taught to expect. We also use the genuine Edison socket, and have not had trouble with a single one of that make of key sockets, but the keyless Edison socket we cannot approve for 220 volts, as the ones we have in our street hoods will short-circuit, unless a lamp is in. This gave much trouble with the street lines at first, not having lamps in all the hoods. The fault is in the tongue of the socket, the space being too small between it and the side.

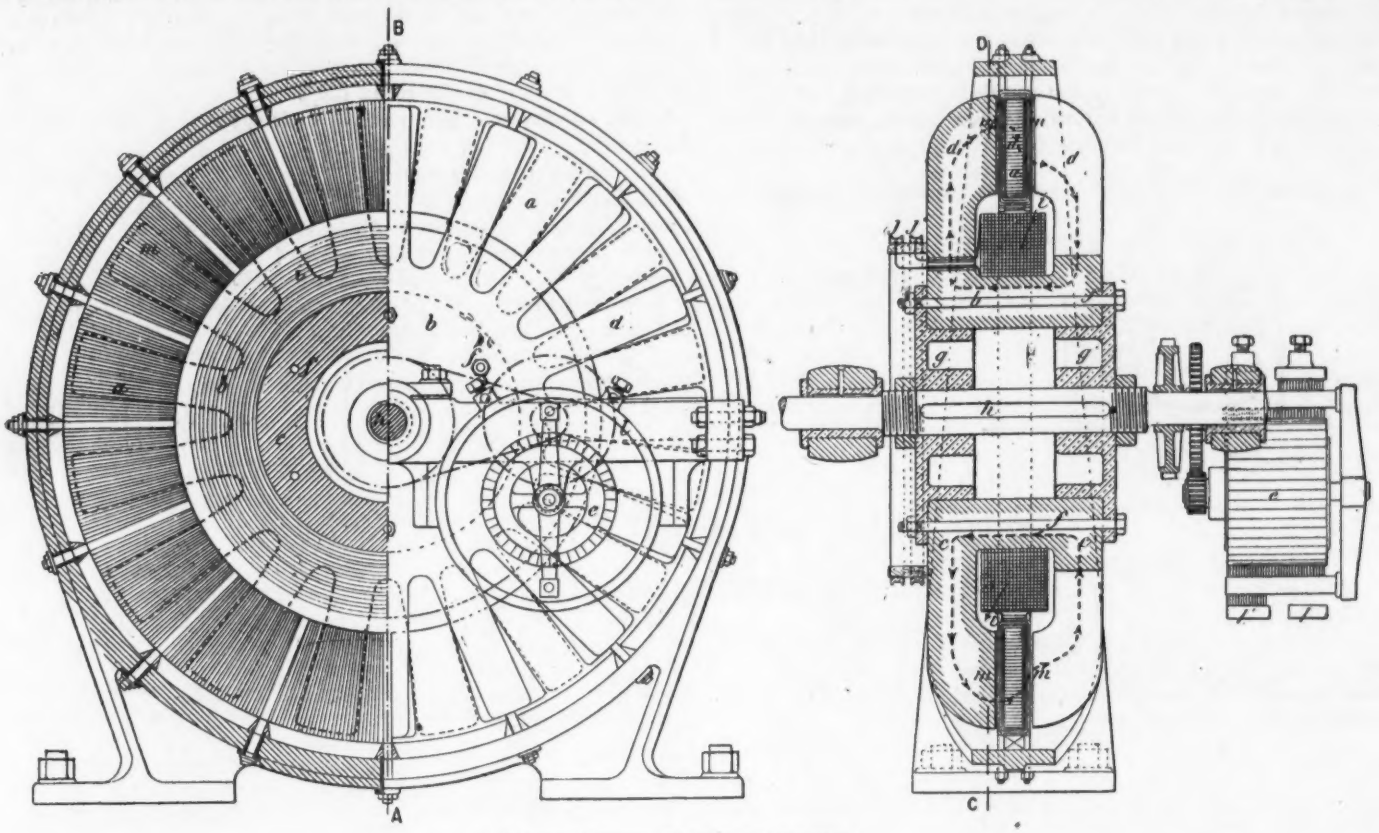
After a daily working experience with this 220-volt plant for some eight months past, my opinion is that for a country town this system will give better satisfaction to the people on whose patronage a plant must depend than either the two or three wire 110-volt system. The voltage on the lines can be kept free from any marked fluctuation; the life of the lamps and even the candle power compares favorably with the best 110-volt lamps. All faults in wire and fittings are shown more promptly, and give less trouble in the end. It costs a little more for power, but the saving on wire and general first cost of the plant, together with a larger list of well-pleased patrons, more than makes up for that one seemingly bad point.

We have a small bipolar 110-volt generator, which is driven by a 20-hp water wheel, and which furnishes light to several stores near the power house. This serves as an object lesson; the difference in favor of the 220-volt part of the plant is so marked as to be noticed by the customers, who have requested us to change them to the 220-volt system, on which the light is more steady. The plant is owned by Mr. Morris E. Lamb.

A Novel Direct-Current Dynamo.

An ingeniously designed electrical machine with revolving field and stationary armature and with commutator brushes driven by gearing at a much higher angular velocity than that of the main shaft is described in a recent number of "L'Eclairage Electrique," the design being that of Rémon-Casas and covered by French patents.

The machine, as shown in the accompanying illustration, comprises an internally rotating field with poles, *m m*, and a single field exciting coil, *i*, concentric with the shaft; all poles of one polarity being to one side of the stationary armature, *a*, those to the left, for example, being north poles and those to the right all south poles. The armature is ring wound, the radial lengths on the flat sides being the active part of the winding. The poles are staggered—that is to say, the south poles on one side are angularly displaced midway between the positions of the north poles on the other. The magnetic circuit thus passes from the north pole on one side through the winding into the armature core, along which it runs circumferentially until opposite the south pole, into which it enters by crossing the winding on the other side of the ring-wound armature. In the machine shown there are thirty-two poles.



A NOVEL DIRECT-CURRENT DYNAMO.

The most interesting feature of the machine is, however, the means of commutation. The commutator segments must, of course, be stationary and connected with the coils on the stationary armature, and the brushes must revolve. To avoid the expensive construction involved in a commutator of conventional design for a 32-pole machine with the large number of commutator segments needed per pole, the brushes are made to revolve at a much higher angular velocity, cutting down proportionately the number of segments. The commutator, *e*, is fixed and the two brushes are rotated by sprocket wheels and a gear, giving, in the case shown, an angular velocity to the brushes sixteen times that of the main shaft, so that the commutator connections and number of brushes are the same as for a bipolar machine. The brushholders also carry outwardly bearing brushes, which run on the collector rings, *l l'*, giving connection to its external circuit. Current is introduced to the rotating field winding through the collector rings, *j j'*. To adjust the brushes to a proper plane of commutation the hub of the driving gear wheel is driven from the shaft by means of an inclined key. The gear wheel can be moved along the shaft by hand, changing its angular relation therewith.

A Means of Reducing Friction in Motor Meters.

In patent No. 611,809, issued October 4, 1898, to Sydney Evershed, London, England, there are described several ingenious means of reducing the friction of motor meters, such, for example, as the Thomson recording wattmeter, and thereby increasing their light-load accuracy. One of these means is the use of a vertical magnet, preferably permanent, with one pole approaching closely the upper end of the motor shaft, which should be of iron or steel, the attractive force being so adjusted by varying the air gap as to just balance the weight of the shaft and the parts carried upon it—namely, the armature and brake. By this means the weight on the jewel, and consequently the friction, can be almost entirely eliminated, and the jewel life greatly lengthened. By pointing the pole of the supporting magnet the tuft of lines of magnetic force issuing therefrom can be made to hold the upper end of the rotating shaft in the proper position, and the friction of a journal for maintaining the upper end of the shaft in its proper position can be also eliminated. The patent also claims the use of a weight supported from a drum connected with the gear train, the weight being such that it will overcome the friction of the train and allow the worm wheel of the motor shaft to permit the train to move and control its movement rather than to drive it. For direct-current meters the patent describes a modified form of commutator intended to reduce the friction, the segments consisting of wires and the brushes also of wires stretched like bow-strings in a direction at right angles to the shaft and bearing lightly on the wire commutator.

American Competition Abroad.

Some of the English electrical papers seem quite concerned about American competition in England. The street railroad at Bradford, for instance, is equipped with an American plant, the important Middlesbrough & Stockton line is American throughout, the new railway at Cork will use American machinery and the extension of the Leeds railways will be made with American materials. Moreover, an extensive lighting plant of the Metropolitan Supply Company is being supplied from America. An editorial in the London "Electrical Review," commenting on this, states that the German and American manufacturers are quick to appreciate the wants of a community and will supply just what is wanted without inquiring whether it is a reasonable or foolish demand; it adds that Englishmen should study the reason of the successes of the Americans.

Electric Traction by Surface Contacts.*

BY PROF. S. P. THOMPSON AND MILES WALKER.

Surface contacts are of interest at the present time because local authorities object to trolley wires, tramway companies do not like the expense of conduits with open slots, and every one is disgusted with the weight and rapid deterioration of accumulator cells. The only other approved method of supplying a tramcar with electric power is by means of surface contacts, and with regard to these people are asking for information.

One of the pioneers in surface contact electric traction was the late Dr. John Hopkinson. In a patent specification filed in 1882 he was the first to describe all the essential features of electromagnetic mechanism for successively connecting the sections of a conductor to a supply main. The object in view at that time was the prevention of the serious leakage which would occur from a long insulated rail. The device that he proposed is shown in Fig. 1. The insulated rail *B* is cut up into sections, b_1, b_2, b_3. Each of these can be connected with a supply cable, *C*, through the switch points, *l l*. The switch is operated in the following way: Suppose a car to be running on the rails picking up current from the section, b_1, and putting it down to the return rail, *E E*. As soon as one of the collecting brushes comes in contact with the section, b_2, current passes round the shunt coils, *S S*, of the electromagnet and to the return rail, *E E*. This raises the armature, *H*, and completes the circuit from the cable, *C*, through *ll* and through *G G*, the series coils of the electromagnet to the section, b_2. At the same time the shunt circuit is broken, the electromagnet being now excited only by the main current passing through *G G*. Thus the car can pass over section, b_2, and as soon as it leaves it the current no longer flows through *G G*, so that the armature drops and the section, b_2, is cut out. It will be noted that the primary object of the invention was to enable *B* to be cut up into sections so as to diminish the leakage which would occur on a very long line. It was not intended to expose a high voltage rail in a public thoroughfare, so no special precautions were necessary to insure the absolute reliability of the switches.

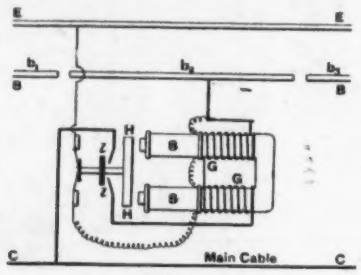


FIG. 1

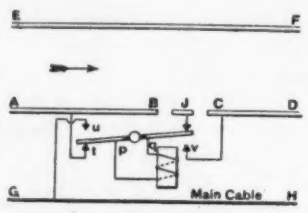


FIG. 2.

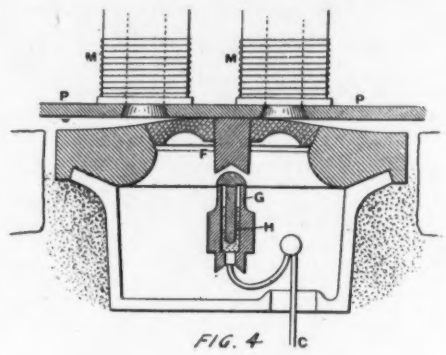


FIG. 4

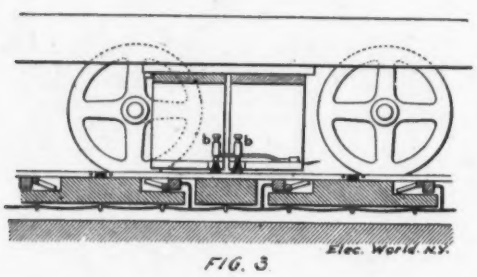


FIG. 3

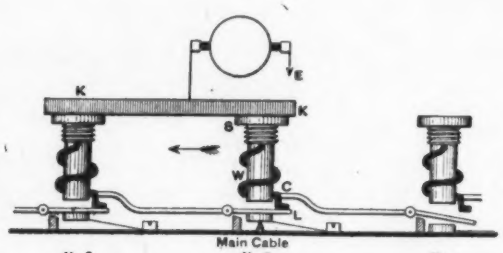


FIG. 6.

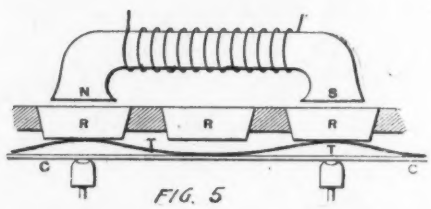


FIG. 5

A year earlier Ayrton and Perry had suggested mechanical and electrical means for effecting the same object, and in 1883 they filed a second specification giving a most complete and lucid account of various ways of connecting up electromagnetic switches and various forms of magnet suitable for the same. It would take too long to give the substance of the 31 drawings of this specification, but it is of interest to notice one of them. In Fig. 2 the sections of the rail are *A B*, *J* and *C D*; *E F* is the return rail; *G H* is the supply cable. The switch lever when not operated upon by the electromagnet rests in the position shown. The locomotive is intended to run in the direction indicated by the arrow. Assuming that the section, *A B*, is "alive" when the locomotive reaches *J*, the main current passes by the contact point, *t*, through the electromagnet by *p* and *q*, and the lever is rocked over making contact between *u* and *v* and thus connecting *C D* to the main. It will be noticed that this method differs from Hopkinson's in so far that it is the main current on its way to the locomotive that first operates the switch. There are really two functions to be performed by the coils of the electromagnet: (1) the switch must be in the first place closed, and then (2) kept closed while the car is running over the section. In Hopkinson's switch the two functions are carried out by a shunt coil and a series coil respectively. Fig. 2 shows the first published method of both closing and holding on the switch by means of the main current. Ayrton and Perry also employed shunt coils as operating coils, and suggested the use of a magnet carried on the car to perform the same function. Indeed, so wide and varied are the descriptions in their specifications that they cover much of the ground of inventors who came after them.

So far the main object in view had been the prevention of leakage from a long line or the automatic blocking of trains by cutting off the supply of electricity from any second train that might run upon an occupied section. But the demand for some system of picking up current without employing a trolley wire or open slot in the road led inventors to try this method of surface contacts for ordinary streets. In 1886 Wynne devised a system in which the contacts were short pieces laid in the road, and connected successively to the main feeder by means of a little trolley that ran in a closed tunnel under the roadway. Then Pollak and Binswanger, developing a suggestion which had been thrown out by Ayrton and Perry, described a method of operating the switches by means of a magnet carried on the car. Fig. 3 shows their specification drawing which certainly has the air of simplicity. In connection with this system it may be well to mention at once Diatto's more recent experiments. Diatto employs an electromagnet (Fig. 4) consisting of a number of cylindrical magnets, *M M*, with their similar poles riveted into a long strip of steel, *P*, thus making up a long polar face which is suspended from the car and extends along its length. This pole comes in contact with an iron peg, *F*, fixed in each road contact, and magnetizes it so that it attracts a movable iron peg, *G*, floating in mercury, *H*, and connected to the main, *C*. Thus connection is made between road contact and the main. Diatto has worked out successfully the practical details of his system on a line in Italy.

There is no doubt that systems based upon this principle have one great advantage over many other systems. The force tending to keep the switch closed can only operate when the car is over the switch. If the contact points of the switch can be made so that they will never stick together, then so far as the safety of the public is concerned there is no better system than this direct magnetic pick-up system. It is, however, to be doubted whether in the small space available under an ordinary electric car there is sufficient room to place a long electromagnet which will operate really reliable switches. The difficulty is increased when going at full speed or round sharp curves. Some methods which are allied to the above are those described in the specifications of Lineff. Fig. 5 illustrates an early type. An iron or steel strip lies in contact with the insulated main conductor; immediately over it are the surface studs. A

*Paper read before the British Association, Bristol, September, 1898.

magnet on the car attracts the strip upwards so that it comes in contact with the surface studs, thus connecting them with the main. As the car moves forward the wave in the strip moves forward like the sinus in the back of the mythical serpent. The method is as ingenious as it is simple, but there must always be a difficulty in making in this fashion a good contact with the surface studs.

The feebleness of the effect under the roadway of a magnet carried on the car has led many inventors to prefer an electric method of communicating with the switch, after the manner of Hopkinson and Ayrton and Perry. Very many different methods of operating the switches electrically have been devised. They fall into three classes: (1) Those in which the operating coil is a shunt to the motor circuit; (2) those in which it is in series with the motor; and (3) those in which it is excited by a battery carried on the car. Each method has its advantages and disadvantages. The main objection to a shunt coil is its cost. It may further be open to the objection that a very small leak in the insulation of the main may be sufficient to keep it in operation when it ought not to be. On the other hand, it has points of advantage over a series coil. As it always exercises the same pull it can be designed to a nicety to do the work required of it, and, in general, can be put into a very small space; whereas a series coil is dependent in its action upon the current taken by the car, and while on the one hand its winding must

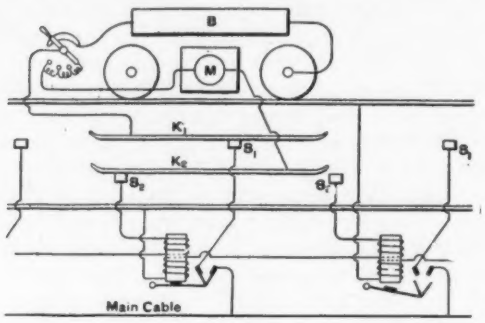


FIG. 7.

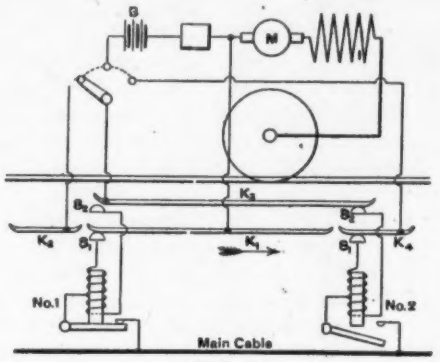


FIG. 8.

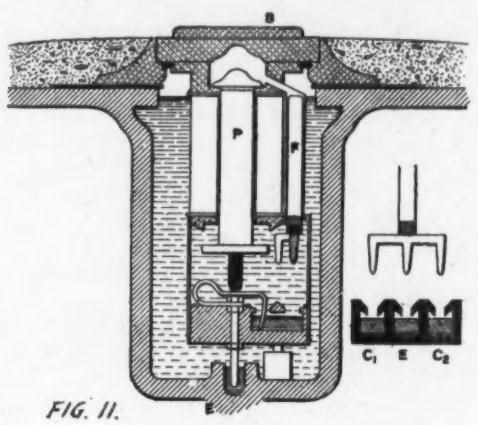


FIG. 11.

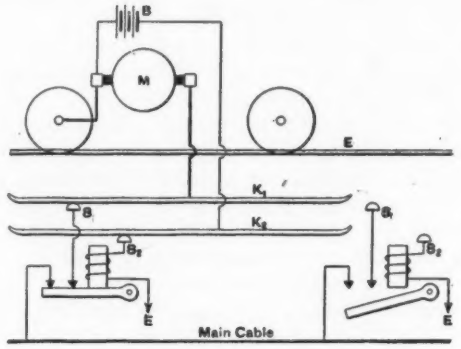


FIG 9

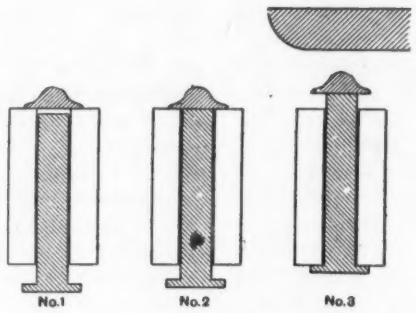


FIG 10

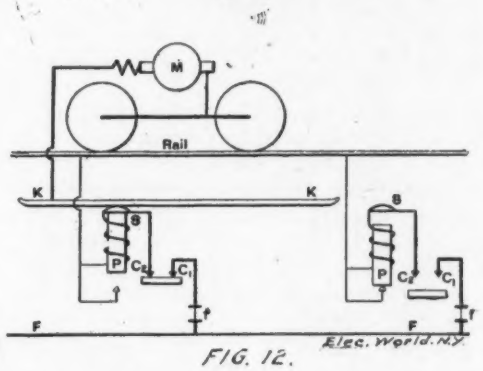


FIG. 12.

be able to carry 100 amperes for a short time, it must have enough turns in it to operate the switch when only carrying two or three amperes. This necessitates a bulky winding, which increases the size of the switch and its box. Besides this the force operating the switch is apt to be too violent with large currents or too feeble with small currents. The great advantage of the series coil has always been that by its use the operation of the switch could be made more dependent upon the presence of the car. If the car is not over the surface-contact it cannot draw current from it, and it might be argued that the series coil would then of necessity have no current through it. This would afford abundant safety to street passengers if it were not for the fact that some current may be leaking from the road contact to mud in street, and this may be sufficient to keep the switch closed.

To illustrate this let us take a very old design of Frank Wynne's. The view (Fig. 6) is, of course, diagrammatic. The car is intended to run in the direction indicated by the arrow. When switch No. 2 is closed current can flow from the main cable by means of the armature, *A*, through the lever, *L*, to the contact, *C*; from thence it passes round the winding of the magnet, *W*, to a stud, *S*, laid in the road. In contact with the stud, *S*, is a long metal skate, *K K*, carried on the car. The current passes to this and on through the motor to earth. As soon as *K K* comes in contact with stud No. 3 the current divides, part of it going through the winding of switch No. 3 and operating it. Stud No. 1 is shown disconnected, the switch having opened when the skate left its stud; but it is easy to see that if current could leak from Stud No. 1 to earth there would be some current in the coil to keep the switch closed. Many devices have been suggested to remedy this defect. Mr. Wynne himself has proposed numerous methods. In a recent design carried out in conjunction with Mr. David Urquhart the current which operates the switch is an alternating current flowing into and out of a condenser. The continuous current which works the car cannot go through the magnet winding because it cannot get through the condenser. The methods suggested by some inventors are exceedingly complex, their diagrams being perfect mazes of connections and interconnections; the number of studs and skates being increased to an alarming extent. One of the simplest arrangements is that of Johnson and Lundell. They adopted a method which originated on the Continent, and consisted in operating the switches by the current on its way from the car to earth instead of on its way from the main to the car. Fig. 7 shows one of their diagrams. It will be seen that the current passes from the main cable through the switch direct to the stud marked S_1 without passing through any magnet winding, thence it passes to the motor by means of skate, K_1. From the motor, instead of going direct to earth, it passes to skate K_2, thence to S_2, and so through the magnet windings to earth. Now the stud, S_2, is at very nearly the same potential as the earth-return, so that the question of leakage from it does not trouble us. By placing S_2 outside the rails it can be effectually guarded against stray currents from S_1. One feature in this design is the interconnection of the switches whereby a switch is operated before it is required to supply current to the car. This gives greater time for the switch to close.

A large number of methods for series working are due to Mr. F. C. Esmond, of New York. One of his simplest is shown in Fig. 8. Here no interconnection is required between the switch boxes, the current being carried forward by means of several skates. In the diagram, Fig. 8, the current is flowing to the motor from the main by means of K_1 and S_1 of switch No. 1. A moment later K_3 will come in contact with S_1. The current will then pass to K_3 and thence by S_2 of switch No. 2, through the winding of that switch to S_1 and thence to the car. Thus switch No. 2 is closed, and the process made continuous. The method of closing the switches by means of an independent battery may be illustrated in Fig. 9. Two rows of studs, S_1 and S_2, are required, and two skates, K_1 and K_2. The diagram explains itself. The practical details of a system of this kind have been brought to great perfection by the Westing-

house Company of America. A branch line of the Washington tramways has been operated by this company since 1894 on what has been called the Wheless system. Mr. Holroyd Smith has described several modifications of the method. There are two drawbacks, apart from the necessity of two rows of studs. In the first place, the accumulator cells are continually in use, and the running of the car is entirely dependent upon them. In the next place, the low pressure of a few accumulator cells is not so satisfactory for overcoming the resistance of mud or ice upon the studs as the full 500 volts of the supply main. It would take too long to describe the commutator system of Claret-Vuilleumier as laid in Paris, and the line equipped at Monte Carlo by the General Electric Company of America. It is sufficient to note that these systems have proved the practicability of picking up current from studs laid in the road.

When we review all these different methods we see that the direct magnetic pick-up systems, with a magnet on the car, while operating with somewhat feeble forces, have a great element of safety in the fact that the forces cannot operate when the car is not there. The system in which the electromagnet is in the switch itself, on the other hand, can be made to operate with very great forces, but there is a danger (only to be avoided by complicating the system) of those very forces keeping the switch closed when the car is absent.

Now, it is possible to combine the advantages of both methods and to avoid their defects. All that is necessary is to make the magnet of the switch operate by attraction on a piece of iron on the car. When the car is absent the switch cannot be held closed because the magnet has nothing to attract; at the same time it is found possible in practice to obtain very great working forces. Upon this principle the authors have constructed an experimental line near Willesden Junction, the main object being to try the practicability of the system upon curves, crossings and sudden changes of slope.

Out of various designs depending on the closing of a magnetic circuit by the iron of the car, the arrangement which has so far proved most successful in experiment consists of an iron plunger sliding in a vertical tube. If we take an iron plunger with expanded ends, like that numbered 2 in Fig 10, and surround it by a solenoid of wire, carrying a current, it is possible to choose the size of the heads so that the tendency of the plunger to assume a central position is balanced by the attraction of the solenoid on the iron heads. With properly chosen heads the solenoid exerts no force whatever on the plunger. Gravity being the only force upon it, it will, of course, take up the position shown. If now, a piece of iron is placed over it, as shown in No. 3, the plunger may be raised by the attraction between the two. In case a very heavy plunger is used it is possible to support part of its weight by merely increasing the size of the lower head by a small amount. Thus we have a simple piece of mechanism whose movement is entirely dependent upon the presence of a mass of iron in its neighborhood, and which cannot be moved by the solenoid itself, even though the magnetizing current carries the iron up to the saturation limit. This has been converted into the operating part of the switch. Now, though the force of attraction is sufficient to lift a fairly heavy plunger and operate a switch, it is desirable to have something more than this. We want a switch which will, notwithstanding its massive moving parts, close in an exceedingly short space of time. We want a very great acceleration upon the moving parts during the first part of their motion. This is easily obtained by merely separating the upper head from the plunger by a short air-gap, and arranging matters so that the mass of iron comes over the switch before current is put through the magnetizing coil. As soon as current passes, the attraction upon the head is so great that the plunger gets up a high velocity before the two come together, with the result that the switch operates as though it had been hit with a hammer. A very simple device, a mere film of oil acting as a cushion, can be employed to prevent the switch from being injured by the concussion.

The connection of this operating part to the contact points of the switch has been the subject of some very varied experiments. It would be a pity to hamper a part so simple in itself with any gear at all. If the safety of street passengers could be made dependent upon nothing else than the falling of the plunger when the mass of iron is removed, it was thought that as great perfection would be attained as we can hope for from any moving mechanism. The attachment of any gear at once introduces the risk of friction and the simplicity of the issue is destroyed. For that reason, as well as for cheapness and convenience, the method shown in Fig. 11 was decided upon, though there are some simpler modifications of it still under experiment. The diagram, which is merely an incomplete sketch for a lantern slide, shows, in the first place, the cast-iron box which is laid in the street. This is surmounted by a gun-metal stud, *S*, faced with a phosphor-bronze wearing cap. The stud is insulated from the iron box by a sheet of micanite. A non-porous road material is placed around the stud to make up the level.

The box is filled with oil, which, besides performing the function presently to be considered, maintains very high insulation throughout. The switch is attached to the stud and comes away with it in one piece. Being only about 4 inches in diameter no difficulty is found in making a perfectly water-tight joint. The next point to consider is the method of making electrical contact. The requirements of switchpoints for disconnecting surface studs are the following:

When closed the contacts should be of low resistance and capable of carrying 100 amperes easily. They should be incapable of fusing or sticking in any way, and should require only a small force to open them. They should retain their shape and efficiency unimpaired for a long time without requiring attention. It will be observed that the current through the stud ceases as soon as the skate parts company with the stud as the car moves forward. Hence in the operation of the car as the switch-plunger falls it does not have to break the main current, that having already ceased. Yet although the switches are not required in the ordinary course to break a large current, it is desirable that they should be able in case of accident to do so without injury. After experimenting with different forms of contact it was found that nothing fulfills these requirements so completely as a properly designed mercury contact. Mercury contacts are, therefore, used throughout these switches.

The yoke of copper which dips into the mercury is supported by a brass tube which floats in the oil and fits loosely into a fixed brass tube, which acts as a guide. When the plunger rises it takes the oil from under the float, which accordingly falls, and connection is made. When the plunger falls the float rises. As the plunger moves quickly the oil has not time to leak past the sides, notwithstanding the very loose fit of the parts and the force upon the yoke piece is very great. At the same time a long movement is obtained.

Safety to the public being the prime consideration, we have kept back our invention until we could be absolutely certain that by no circumstance likely in human probability to arise could the switch be left alive. To operate the switch contacts requires a fraction of an ounce. The forces which operate on the moving plunger (which slides freely in a brass tube in oil) are over 80 pounds at the commencement of the stroke, and are several pounds at the end. The sliding plunger itself weighs 3 pounds. We have, therefore, a margin of safety of many hundred per cent. As the car passes on, there is a breaking of the magnetic and also of the electric circuit, making security doubly sure. And there is yet a third line of defense to the public in that our switch is actually earthed, if when the car passes on the switch fails to open, for then the plunger earths the switch. In that event the fuse would be blown, effectually protecting the public from the possibility of a stud being left alive in the roadway.

It will be seen from the diagram that three cups are employed; the two outer being connected to the main and the stud, respectively. The main cup is enclosed in a metal sheath (not shown) permanently connected to earth, so that it is impossible for current to reach the stud except when the yoke is down. Now it will be seen from Fig. 11 that when the plunger is down it earths the centre cup, so that if from any accident whatever the yoke piece fails to open the switch after a car has gone past, the plunger puts the stud to earth and blows the fuse between it and the main. It is not necessary to have any special mode of connecting up the switch boxes.

Either shunt or series coils may be used. In practice we prefer a shunt coil because the slightly increased expense is more than compensated for by the smallness of the bulk. Our connections are shown diagrammatically in Fig. 12, which sufficiently explains itself. Only one skate is employed, and this is in the centre of the car. This gives much greater facility in going round curves than where two skates and two rows of studs are necessary.

There are a number of practical details for which we have no room here, but which we hope shortly to bring before the Institution of Electrical Engineers. Throughout the work upon the experimental line we have been indebted to Mr. C. E. Holland for many valuable suggestions.

Report of the American Association for the Advancement of Science Committee on Standards of Measurement.*

The determination of the mechanical equivalent of heat by the electrical method, as reported by Griffiths,[1] and by Schuster and Gannon,[2] gave a larger value than Rowland's corrected result. This fact has created a demand for the redetermination of the ampere in terms of the electro-chemical equivalent of silver. At the Toronto meeting of the British Association last year a grant was made to the B. A. Committee on Electrical Measurements for the purpose of carrying out this investigation.

At the Detroit meeting of this association the grant of $50 previously made for the use of this committee was made available for the past year. Though this appropriation was clearly insufficient for the purpose, it was decided that the redetermination of the ampere should be undertaken for the committee of this association in the physical laboratory at Ann Arbor. The work has been ably carried to completion by Professor Patterson and Dr. Guthe.

The discrepancy between Griffiths' results and those of Rowland is about one part in 400 at all temperatures between 15° and 25° on the nitrogen scale. Those of Schuster and Gannon exceed Rowland's at 19.1° on the same scale by about one part in 500.[3] These differences exist after the final elaborate comparison of thermometers and the reductions to the same absolute scale of temperature.

Since the electrical methods employed to determine the mechanical equivalent of heat involve either the current and the e. m. f. of the Clark cell, or the square of this e. m. f., and since the e. m. f. of the Clark cell is determined by means of the silver voltameter, it is evident that the current enters the final result as the square. If the discrepancy is due entirely to an error in the value of the ampere, assuming the ohm to be correct, then the ampere should be one part in 1000 to one part in 800 larger than the present accepted value. That is, the electro-chemical equivalent of silver should be increased from Lord Rayleigh's value of 0.001118 to 0.0011191 or 0.0011194. Lord Rayleigh does not claim for his result an accuracy greater than one part in 1000.

The method used by Patterson and Guthe was that of a specially constructed electrodynamometer of large dimensions, and the employment of the torque of a phosphor-bronze wire to equilibrate the counter-torque due to the effort between the magnetic fields of the stationary and movable coils. This method eliminates entirely the value of gravity, *g*. The torque of the wire was measured by observing the period of vibration of a cylindrical brass weight of known mass and dimensions when suspended by the phosphor-bronze wire. The entire success of this part of the investigation was due to the fact that the observations were made with the whole apparatus enclosed in a fairly good vacuum. Under these conditions the vibrations could be followed for hours at various intervals; the logarithmic decrement was almost entirely constant, and it was easy to obtain a curve connecting temperatures and periods of vibration as a torsional pendulum. The wire was so connected to the support and to the brass cylinder that it could be transferred from the vacuum apparatus to the electrodynamometer and back again without disconnecting it from the terminal pins. From personal inspection at the several stages of the investigation assurance can be given that the work has been most carefully executed at every point, and all known sources of error have been as completely eliminated as possible. The result of the investigation is that the electro-chemical equivalent of a used solution of neutral silver nitrate, fifteen parts by weight of the silver salt to eighty-five parts of distilled water, is 0.0011192 gm. per ampere per sec. This exceeds Lord Rayleigh's value by about one-ninth of one per cent. and causes the discrepancy in the mechanical equivalent of heat to disappear.

The corresponding change in the e. m. f. of the Clark cell will be from 1.4342 to 1.4327 at 15° C. A direct determination has not yet been made and this redetermination is reserved for the coming year.

Dr. Kahle has obtained for the electro-chemical equivalent of silver the value 0.0011182[4] by the use of an electrodynamometer designed by von Helmholtz and a fresh solution of the salt. Pellat and Potier found the same value as that of Patterson and Guthe.[5]

*Presented by Prof. Henry S. Carhart, secretary of the committee.
[1] "Phil. Trans., A," 1893.
[2] "Proc. Roy. Soc.," November, 1894.
[3] "Johns Hopkins University Circulars," June, 1898.
[4] "Wied. Annal.," Vol. 59, p. 532.
[5] "Journ. de Phys.," 9, p. 381, 1890.

Secrecy in the Telegraph Service.

An interesting incident in connection with the use of the telegraph system by the Secret Service is given in an account of the work of this department in connection with the recent war, by Chief Wilkie, in the New York "Herald," from which the following is reprinted:

When the "emergency men," as the temporary employees of the division were termed, were instructed in the use of the cipher code they were told that in communicating with headquarters they should use, instead of my name, "John Ehlen," which I had registered with the telegraph companies. This was simply a precautionary measure intended to protect the operators by eliminating the chance that some one might discover the message was for the Secret Service, identify the sender as a member of the division, and destroy his usefulness in that particular locality, if nothing worse.

Out of this arrangement grew a curious incident. In the latter part of May a young Western newspaper correspondent, stationed in Washington, sent in his card, asking to see me on important and confidential business. When admitted he explained that a telegraph operator, whom he had known for years in the West, and who had been transferred to the capital, had intercepted a cipher message from Montreal the night before, and believed it was from the Spanish headquarters to an agent here. We were particularly interested in the Spanish messages at that time, having possession of a cipher that was being used in some of their correspondence, and the newspaper man, knowing this, had suggested to his friend the operator that the suspected communication be submitted to our office.

He had tried to translate it, but was unable to succeed, and he wondered if we would have better luck. The copy of the mysterious message, which he then produced and placed before me on the desk, was addressed to my alias, the original, from one of my men, being in a drawer at my side. Under the circumstances I felt moderately certain that we could get at its meaning, but without explaining to the correspondent I told him that if we did succeed in deciphering it, and the contents wer of such a character as to permit of their publication, he should have a "scoop" on it. This satisfied him, and he went away.

A little later I called up the telegraph company and asked that the operator in question should be sent to the office for a moment. In a few minutes he was ushered in—a young, bright-faced fellow, with plenty of color in his cheeks and an air of suppressed excitement.

I only guessed that he felt his discovery had been of value to the Government, and he was to be rewarded in some way. In reply to my question he detailed how he had received the message, and how, when it occurred to him that it might be from one Spanish agent to another, he had surreptitiously obtained a copy of it. The fact that it bore no local address had made it doubly suspicious, as it indicated that it was to be called for.

"Didn't it occur to you to see if the person to whom it was addressed was registered in the office with delivery directions?"

"No, sir."

"Well, if you had consulted your company's books you would have discovered that I am 'John Ehlen,' and that this is a Government message."

The poor fellow's face was a study when he realized that he had held out an official telegram and had turned it over to a newspaper man.

He appreciated the gravity of the offense in violating his oath as an operator, and felt that his position was as good as gone, under circumstances that would make it impossible for him to obtain employment with any company. He said nothing, but his eyes filled with tears.

"Have you a family?"

"No, sir; but I am supporting my old father and mother."

"Your motive was the best in the world," I said, finally, "but your methods are open to criticism. Now, nothing shall be said to the company about this, but if in the future you catch any mysterious messages just bring them straight to me without intrusting them to any outsider. If your newspaper friend had succeeded in translating this message it might have been awkward for all of us."

This was true, for the message in question detailed briefly, but completely, the capture of the Carranza letter. He gave me a grateful pressure of the hand, and the incident was closed.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE
AMERICAN AND FOREIGN
By Carl Hering

Dynamos, Motors and Transformers.

THEORY OF THE ROTARY TRANSFORMER. Kapp. "Elek. Zeit.," Sept. 29.—The conclusion of his long article (see "Digest" last week). He discusses the four-phase transformer; a rotary transformer supplied with two-phase current is really a four-phase transformer; he shows that a machine in which the pole breadth is two-thirds the pole distance will yield as a transformer 67 per cent. more than if it is used as a continuous-current machine; when the pole breadth is one-half the pole distance, the increase is 69 per cent.; with four-phase transformers the breadth of pole has therefore no particular effect on the output; the magnetic field can, therefore, be designed with reference to the conditions for the continuous current as distinguished from the alternating current. The three-phase transformer is next considered, and it is shown that it will yield 38 to 44 per cent. more, according to whether the polar width is great or small, than it would yield as a continuous-current machine in which the same heat was generated in the armature. The six-phase transformers are then briefly considered; they are shown to be more favorable than the four-phase transformer, as the armature, for phase equality, yields nearly double that of a mechanically driven continuous-current machine; the pole breadth has no effect and phase-shifting only a very slight one. In conclusion he gives a brief summary in the form of the following table; three, four and six-phase transformers were considered only for phase equality, and the numbers in the table for phase difference are only approximate. This table gives the output of the rotary transformer expressed in percentage of that output which the armature would yield as a continuous-current generator, for the same heat generated in the copper of the armature. The pole breadth is given in terms of the distance between the centres of the poles.

Type of Rotary Transformer,	Phase Shifting.	Theoretical Limit (Steinmetz).	Pole ⅔	Width. ½
Single-phase	cos = 1	85	88	95
	cos = 0.9	..	81	88
	cos = 0.8	..	73	80
	cos = 0.7	..	63	70
Three-phase	cos = 1	134	138	144
	cos = 0.9	..	128	137
	cos = 0.8	..	117	126
Two or four-phase	cos = 1	164	167	170
	cos = 0.9	..	160	167
	cos = 0.8	..	144	153
Six-phase	cos = 1	196	198	199
	cos = 0.9	..	192	196
	cos = 0.8	..	177	188

ROTARY TRANSFORMERS. Marchena. "L'Ind. Elec.," Sept. 10.—The conclusion of his long article (see "Digest" Sept. 24)). As the results of his study he draws the following conclusions: There is no advantage in compounding alternators intended for feeding such converters; neither is there any advantage in providing for close regulation; on the contrary, alternators having considerable self-induction are very well suited and give the least wattless currents; this refers to alternators which are used exclusively for supplying the converters. When the alternators are compounded to give a constant potential, or when the converter is attached to a constant potential circuit, it is necessary to insert in the circuit a reaction coil. There is no advantage in adjusting the excitation of the converter so as to have the power factor equal to unity at full charge; it is preferable to annul the wattless current for a load of 70 to 80 per cent.; this is illustrated with an example. He concludes that in every different installation it is necessary to study the particular conditions under which the converters are to be run, in order to determine the different data in a rational manner.

ELECTRIC GENERATORS. Parshall and Hobart. Lond. "Engineering," Sept. 16.—In this continuation of their long serial they begin the discussion of constant-potential continuous-current dynamos. They show that the magnetic circuit, the thermal limit, the efficiency and regulation, although important, are all secondary to the question of commutation; the latter subject is then discussed at length; the important requirement for sparkless commutation is shown to be that the current in the coil short-circuited by the brushes, should be equal to half the main current—that is, to the current which will go through it after leaving the brush. The more general use of radial bearing carbon brushes is pointed out. The proper design of the parts of a dynamo has enabled manufacturers to dispense with the many ingenious and complicated windings for modifying sparking, and it is therefore not necessary to resort to these, as the careful application of the ordinary methods has brought the dynamo to such a stage of development that the thermal limit is reached below that output at which harmful sparking occurs. The subject of armature interference (also known more generally as armature reaction) is then discussed; they show what is meant by it and how it acts. Some tests are described in which the field and the air gap were measured under various conditions; some similar tests by Hopkinson are also cited. The discussion of the application of these considerations to the proportioning of dynamos is then begun.

CALCULATION OF DYNAMOS. Sumec. "Zeit. fuer Elek.," Sept. 25.—The first part of an article in which he describes a general method of calculating electrical machines, including continuous and alternating-current dynamos and motors; it is intended chiefly to give a general insight to the subject; the mathematics involved appear to be relatively simple; he claims that the method is free from the numerous coefficients and complicated formulas; it appears to differ considerably from the usual methods.

CALCULATING THE AIR SPACE RELUCTANCE FOR TOOTHED ARMATURES.—Lond. "Elec. Eng.," Sept. 30.—Answers to a request to show how this is calculated, and how the length of the path through such an armature is determined.

EXPLORING THE POTENTIAL AROUND COMMUTATORS. Shepardson. "Amer. Elec.," Oct.—Brief descriptions of the usual methods, with a reference to a simple method used in the laboratory of the Univ. of Minn. with satisfaction. There is a strip of hard fibre formed so as to encircle half the commutator; a row of radial holes is drilled through it, the spaces being equal to the divisions of the commutator; the piece of fibre is held in position by cords; the third brush consists of a wire, which is passed through each of these holes in succession, the voltage being measured between that and one of the other brushes, or between two brushes placed in successive holes.

MULTIPHASE ARMATURE WINDINGS. Stone. "Amer. Elec.," Oct.—The continuation of his well-illustrated article describing these windings.

Lights and Lighting.

ARC LAMP. Duflos system. "L'Elec.," Oct. 1, and "L'Ind. Elec.," Sept. 10; abstracted in Lond. "Elec. Rev.," Sept. 30.—An illustrated description of this lamp, which has neither a brake nor a similar mechanism; the regulation is produced by a shunt electromagnet, by means of which as great sensitiveness is said to be produced as that in differential lamps.

ARC LAMP. Souga system. "Elek. Zeit.," Sept. 29.—An illustrated description of this inclosed lamp, which is made for continuous or alternating currents from 2.5 to 9 amperes.

TRAIN LIGHTING.—"El'ty," Oct. 12.—A very short description of the system used on the postal cars of the Atchison, Topeka & Santa Fé Railroad. A dynamo is belted to the car axle, the current being stored in a battery. This system has been used since last March, and seems to have been perfectly satisfactory. The speed of the armature is kept as nearly constant as possible by an arrangement of pulleys not described. A note in "Eng. News," Oct. 13, states that electric lighting from the car axle has been adopted on the limited trains of that railroad, running a distance of 2209 miles; the aggregate candle power will be about 4928, which includes a locomotive headlight and a lamp in each berth.

TRAIN LIGHTING.—"Prog. Age," Oct. 1.—A reprint of an article from the "Railroad Gazette," Sept. 16, describing a system used in England. A dynamo and accumulators are carried in the guard's compartment, the dynamo being driven by a belt from the car axle; it is so mounted that when the speed of the axle exceeds a certain amount the belt is made to slip, so that the speed of the dynamo is practically constant. There are about 1000 cars in use which are provided with this system, known as the Stone system and invented by Gill.

INCANDESCENT LAMP MANUFACTURE.—"Elec. Eng.," Oct. 13.—A description of the process of the Shelby Company.

Power.

LIGHT AND POWER ON THE MIDLAND RAILWAY. Langdon. Lond. "Elec.," Sept. 30.—A reprint of a paper read before the Institution of Mech. Eng. on "The electric current for lighting and power on the Midland Railway, and driving machinery direct by electric motor, without shafting." This railway has established a number of installations, aggregating about 3500 horsepower; a list of these installations is given in a table, which also gives the cost of working of each for a half year; both the series and the parallel systems of arc lights are used. Recently high-tension direct-current machines have been added, the power from which is transformed down to a lower potential at distant stations; the transmission voltage is 2200 and the final 210. A more complete description of the Derby station is given; this contains compensators or regulators, automatically controlling the voltage; these consist of two series dynamos coupled together and driven with a shunt motor, the current from the outside mains of the three-wire system being sent through them in the usual way; they have an additional coil, which is connected in series with the middle or neutral wire, but it is wound in the opposite direction on each of the series machines; any drop in the third wire due to the current in it is thus compensated automatically by the volts being raised on one com-

pensator and dropped in equal amount on the other. The latter half of the paper is on the application of power, which is becoming daily more recognized. Two tables, which are well filled, give the data for the power absorbed by tools and shafting, which was carefully measured; one of these contains much data for each of a number of machine tools driven by countershafts, both light and loaded, including also the amount of metal cut away. The second table gives a comparison between driving a lathe through countershafting and directly. A 9.5-inch screw cutting lathe driven by countershafting and cutting down a bar of gun metal, required 495 watts per ounce of metal removed per minute; by gearing to it directly an electric motor, the consumption was reduced to 214 watts; this was when it was making one cut; when making three cuts simultaneously the power averaged 275 watts per ounce per minute, or when direct-driven 143 watts; multiplying the watts by the time occupied to do the same work in each case, the relative values are for one cut 3 to 1, and for 3 cuts 2 to 1. The waste of power in shafting and belting would not be so great in relation to the work done, for larger tools; with large machines, absorbing 1 horse-power, there can be no question of the advantage derived by direct driving from electricity. The data are given in very complete form, and seem to be a valuable addition to the information on this subject.

TRANSMISSION OF POWER. Janet. "L'Eclairage Elec.," Sept. 24; translated in abstract at some length in the Lond. "Elec. Rev.," Sept. 30.—Abstracts of the article noticed in the "Digest" Oct. 8. He recommends that every workshop, warehouse and workman's lodging or home should be provided with power from some central point.

ELECTRIC STEERING GEAR. Fischer-Hinnen. "L'Eclairage Elec.," Sept. 24.—An illustrated description of the Giles and the Pfatischer systems, which he considers the two best systems now in use for vessels.

GRANADA. Ritter. "L'Ind. Elec.," Sept. 25.—An illustrated description of this plant in Spain, in which a water power having a fall of 330 feet is used. The simple alternating current of 4200 volts is used.

VARYING THE SPEED OF MOTOR-DRIVEN FEED PUMPS.—Lond. "Elec. Eng.," Sept. 30.—Brief descriptions of several methods.

BLAST-FURNACE GAS AS MOTIVE POWER. Savage. "Cassiers' Mag.," Oct.—A short article on the use of such gases for driving gas engines. Experiments seem to show that as much as 20 indicated horse-power may be obtained per ton of coke fed to blast furnaces; these gases are now going to waste at most places; he suggests that electric transmission would provide a convenient means for distributing this power.

ELECTRICALLY DRIVEN SHIPYARD TOOLS. Kodolitsch. "Cassiers' Mag.," Oct.—A well-illustrated article on the numerous electrical appliances used by his company at Trieste, Austria. He emphasizes the convenience and economy of electric power in such cases.

WATER-POWER PLANT.—"Amer. Elec.," Oct.—An illustrated description of the plant of the Fries Company in North Carolina, for transmitting power to Winston-Salem. One thousand horse-power is to be transmitted in the form of three-phase current at 10,000 volts, the line being 70,000 feet long.

ELECTRICAL REFRIGERATION. Fay. "Elec. Eng.," Oct. 13.—A continuation of his article (see "Digest" last week). He describes a number of machines which he constructed and criticises them.

Traction.

ELECTRIC TRACTION. Carus-Wilson. Lond. "Elec. Eng.," Sept. 30.—The beginning of a reprint of his Cantor lectures; these will be confined to the subject of the direct-current motor as applied to traction. He begins by considering the motor in a state of rest, the whole of the first lecture being devoted to this; he introduces the quantity which he calls the "induction factor," which takes an important part in his method of treating the subject. The method described appears to be similar, if not identical, with the one shown in a former paper abstracted in the "Digest" June 18, 25 and July 2.

SURFACE CONTACT SYSTEMS.—"Zeit. fuer Elek.," Sept. 18.—Illustrated descriptions of the Esmond, the Wynne and the Union Electric Company systems, taken from patent specifications. It is remarked that the Claret-Vuilleumier system "was" in use in France for a year and a half (from which it would appear that it is now abandoned); in Prague the Krizik system is in use; on an electric line in Monaco the contact knob system is in use.

ELECTROLYSIS OF WATER PIPES AT DAYTON.—"Eng. News," Oct. 6.—Long extracts from a report of what appears to be a very thorough investigation of the damage done by electrolysis to the water mains of that city. After pointing out the well-known principles of such electrolysis and referring to tests made by measuring the voltage betwen the rails and the fire plugs, a description is given of the condition in which pipes were found after being exposed. Among other well-known effects, it was found that tar seems to be no protection whatever, as the pipes were found to be covered with a black material resembling graphite, which was an excellent conductor; stone and pebbles near the pipes in some cases seem to have been electro-plated with the metal of the pipe, which one of the experts, Brown, believes has never been observed before; the tensile and transverse strength of the pipes was measured, and a reduction of from 30 to 50 per cent. was found. In a saturated solution of sal ammoniac 100 amperes will remove 3 pounds of iron in twenty-four hours, or with the proper solution 20 pounds of lead. According to Brown, the measurements do not bear out the claim that cast-welded joints will entirely obviate the effects of electrolysis. Some measurements showed that the pipes at certain points were carrying 95 per cent. of the current, the other 5 per cent. being divided between the two rails. The report concludes with an estimate of the damage done; it appears that the total length of pipe affected amounted to 46,000 feet. It is estimated that there would be no injurious electrolysis 20 feet either side of the car tracks. Rowe, of the Water Works, calls attention to the additional risk in case of fire, while the damaged pipes are being replaced by new ones; also to the cost of repaving the streets and the large portion which would be borne by the property owners; the cost of replacing the pipes is estimated at $77,000. With a difference of potential of 4.5 volts it is shown that a 6-inch pipe can become useless in five years (but this would evidently depend on the current, and not on the voltage alone.) He claims that the city should be reimbursed for the damage sustained, and questions the feasibility of replacing the pipes, as they will again be subjected to destruction.

STORAGE BATTERY FOR ELEVATED RAILROAD. Cravath. "Elec. Eng.," Oct. 13.—An article on the performance of the battery which is used on the South Side Elevated Railroad of Chicago. The load in this plant is said to be without doubt the most fluctuating of that in any other large station; the batteries are placed near the ends of the line and are connected directly to the line without any auxiliary regulating apparatus. Two diagrams give the curves of fluctuation with and without the battery, and show the effect of the battery in greatly reducing the fluctuations. With the battery in use the maximum was 5700 amperes as against 7500 without the batteries, while the minimum was 3000 as against 1700; before the batteries were in use the load was almost more than the four generators could carry, while now it is hardly a full load for three of them; the average current at the power house per car during heavy loads is less with the battery than without. The kilowatt hours per car mile required on this road are 2.08.

ELECTRIC STREET TRACTION IN ENGLAND. Knox. "Eng. Mag.," Oct.—A long article on the legal aspects of electric street traction in England. After referring to the social side of electric traction, he calls attention to the fact that London, although the richest city in the world, has the most meagre system of traction in the world, operated by the most antiquated method, and he then shows that this is due to the English law concerning tramway undertakings.

LIGHT RAILWAYS IN GREAT BRITAIN. Spagnoletti. "Cassiers' Mag.," Oct.—A brief article on light railways in general, without special reference to electric railways.

BRUSSELS.—"West. Elec.," Oct. 8.—A translation in abstract, with illustrations, of the article noticed in the "Digest" May 28, descriptive of the railway lines.

TRACK CONSTRUCTION. Gibbon. "Elec. Eng.," Oct. 13.—An article on its defects and the remedy, in which he describes his lap joint rail.

Installations, Systems and Appliances.

INSTALLATIONS IN SWITZERLAND.—"L'Eclairage Elec.," Sept. 24.—Statistics for the year 1897 compiled from official reports. There were thirty-five installations, comprising a total of 4989 kw; a double-page table contains data concerning the principal plants for the electric transmission of energy in Switzerland.

THEATRE PLANT.—Lond. "Elec Rev.," Sept. 30.—A brief, illustrated description of the private plant at the Palace Theatre of Varieties. Structurally and decoratively this is thought to be the finest theatre in London.

PLANT IN THE CHAMBER OF DEPUTIES. Laffargue. "L'Ind. Elec.," Sept. 10.—An illustrated description of this plant in Paris. There are four gas engines of 50 horse-power and two of 30; the two-wire system at 110 volts with a battery of accumulators is used.

HOFOR'S IRON WORKS.—Lond. "Elec. Eng.," Sept. 20; reprinted, without the illustrations, in "El'ty" (N. Y.), Oct. 12.—A brief description of this plant in Sweden, which is for both lighting and the transmission of power.

CHARGING FOR ELECTRIC ENERGY. Meynier. Lond. "Elec.," Sept. 30.—An abstract of the article noticed in the "Digest" last week.

COMMERCIAL ASPECTS OF ELECTRIC SUPPLY.—Gibbings. Lond. "Elec.," Sept. 30.—In this continuation of his long serial he gives some data regarding cranes and hoists; also a list of the number of motors used for electrically driven printing machines.

NEW YORK STATE CAPITOL.—"Elec. Eng.," Oct. 13.—Some illustrations of the building, accompanied by a very brief statement of the number of lights, their distribution and the difficulties encountered in the wiring.

MUNICIPAL OWNERSHIP. Hopkins. "Elec. Eng.," Oct. 13.—The first part of an article on some views and data on municipal ownership.

Wires, Wiring and Conduits.

INTERIOR WIRING. Gardner. "West. Elec.," Oct. 8.—An article describing how to calculate the wire for simple cases; it is intended for those who have no technical training and for beginners. It contains also a table from which the gauge numbers of the wires are found directly for various numbers of lamps at various distances.

INTERIOR WIRING. Knox. "Amer. Elec.," Oct.—An article on the feeders and mains in a building.

Electro-Physics and Magnetism.

ELECTROSTATIC CAPACITY OF WIRES. Moon. Lond. "Elec. Rev.," Sept. 30.—An article containing formulas for the capacity of wires under various conditions. These formulas are too numerous to be given here, but some of the deductions may be of interest. One of the formulas gives the capacity in microfarads of a mile of wire of any given diameter, suspended at any given distance from earth; another gives the capacity between two wires of the same diameter entirely isolated from other wires, and the earth; another gives the capacity of a cable. The capacity between a wire and a number of other wires and the earth cannot be as great as twice the capacity between that and the nearest wire, if the two wires are of the same diameter and are entirely isolated. Two wires would have to be nearly equal in capacity before their capacity as isolated wires is equal to that between either wire and the earth; therefore the capacity between one wire and any system of wires and the earth could in no case be as great as twice the capacity between one wire and the earth. There are certain well-defined limits between which the capacity between one wire and a number of others and the earth must lie, and it is not difficult to assign probable average values for the capacities of any such wires; this he discusses. He shows that the capacity between two wires is small, being in fact in practice between one-thirtieth and one-sixtieth of the capacity of one wire with the remainder and the earth. He discusses the charge the wires take. He shows that the effective capacity of one wire of a perfect looped circuit may be taken as the sum of the capacity of either wire with the remainder and earth, and the capacity between the two wires of the loop. In calculations relating to perfect telephone looped circuits one wire only of the loop should be taken, and it should be assumed that this wire is actuated by half the voltage of the circuit. A table gives the capacities of four different sized wires under various conditions.

LUMINOUS VARIATIONS CONVERTED INTO RELIEFS. Dussaud. "L'Eclairage Elec.," Sept. 24; "L'Ind. Elec.," Sept. 25.—Translated in abstract in the Lond. "Elec.," Sept. 30.—A French Academy paper in which he describes a method in which he endeavored to obtain a moving relief whose projection should be proportional to the variations of intensity produced in a beam of light. The light falls on a set of selenium plates, which in turn vary a current in the primary of an induction coil, whose secondary current is transmitted over a line to a telephone whose membrane acts, by means of a multiplying system, upon a system of rods, raising them more or less against a diaphragm on which a moving relief is felt by the fingers. It is thought in the English abstract that this may be a germ of something of great importance to the blind.

PRESSURE IN THE INTERIOR OF VACUUM TUBES. Seguy. "L'Eclairage Elec.," Sept. 17, and "L'Ind. Elec.," Sept. 25.—A reprint of an Academy note, in which he enunciates the following law: The internal pressure in an exhausted vessel is neither uniform nor constant in all the parts of the vessel when it is traversed by an electric current. To prove this he experimented with a tube 4 metres long and exhausted to a millionth of an atmosphere; when a current was passed he found that for about half the length of the tube from the cathode end the vacuum was about the same, but near the anode the pressure had been raised to about a thousandth of an atmosphere.

EARTH CURRENTS AND MAGNETIC PERTURBATIONS. Lemstroem. Lond. "Elec. Eng.," Sept. 30.—An abstract of his paper read before the Conference on Terrestrial Magnetism. He discusses the relation between the variations in the earth currents, the electric currents from the atmosphere, and the magnetic perturbations. After an historical sketch of the observations made on earth currents, he describes his method of measuring the e. m. f. of the currents from the atmosphere and shows that the variations of earth currents occur a short time—about five minutes—before the magnetic perturbations, and that the former are more numerous than the latter; all of the latter, however, are not preceded by variations in the earth currents, and these are probably caused by atmospheric currents. The causes of magnetic variations should, in his opinion, be sought for in the polar regions as the magnitude of the variations increases rapidly with the latitude. He recommends establishing two international polar stations.

SPECULATIONS CONCERNING ROENTGEN RAYS. Woodward. "Elec. Eng.," Oct. 13.—A short article on the nature of these rays. Believing them to be vibrations of an inconceivably short period, he suggests that the rays may be very closely related to those of the solar spectrum, whose period of vibration is very short. He suggests that we might call electricity an "effect produced by a vibration capable of a minimum and maximum period, and, according to the length of the vibration period, are produced sound, heat, light, Röntgen rays, and electricity, in the sense we have understood it."

MAGNETISM. Bain. "West. Elec.," Oct. 8.—A short article of a general character criticising unfavorably the usual definitions, conceptions and methods of calculating magnetism. He claims that there are many reasons why the ampere-turn method of determining the magnetism of an electromagnet is entirely unreliable. A magnetic unit, he thinks, should be equal to the product of the amperes into the turns per square inch section of pure iron.

Electro-Chemistry and Batteries.

ELECTRICAL BLEACHING.—"L'Elec.," Sept. 24.—A reprint of an article from a paper journal. Attention is called to the success of the electro-chemical bleaching processes; the principal difficulties are in connection with the accessory reactions. The Kellner electrode is well spoken of; it consists of numerous platinum points projecting from a plate of ebonite, like the bristles of a brush; with this one can obtain solutions containing more than a hundredth of active chlorine, which is a degree of concentration probably more than sufficient for most practical purposes. The advantages, apart from the economy, are pointed out; for showing the economy, the costs are worked out for an installation using 900 kg of chloride of lime per day. Assuming twenty-four hours a day, then 100 horse-power would be required; the first cost of such an installation would be about $10,000; the daily costs, assuming water power, would be about $20, or assuming steam power, about $35; the estimates are made for the conditions in Austria; the cost of the 900 kg of chloride of calcium is at least $45, showing very good economy when water power is used, while even with steam power considerable economy is obtained.

ELECTRO-DEPOSITION OF CHROMIUM. Cowper-Coles. Lond. "Elec. Rev.," Sept. 30.—A summary of various processes, preceded by a description of the properties of this metal. A table gives the relative hardness of various deposits in the form of the number of grams weight on a diamond point required to produce a scratch; in this, chromium deposit on copper is 7.0, while nickel plate is 10.0.

ELECTRICAL DEPOSITION OF GOLD. Andreoli. "L'Elec.," Oct. 1.—The first part of an article on this method of obtaining gold from its ores as used at the Transvaal; this is the only place where the electrolytic process is used in practice. The method used is that of Siemens & Halske, in which the gold is deposited on the lead; Andreoli suggests using iron for the cathodes, but in no case should aluminum be used.

METALLIC SULPHIDE ELECTRODES. Bernfeld. "Zeit. Phys. Chem.," 25, p. 46; abstracted at some length in the "Zeit. f. Elektrochemie," Sept. 29.—Descriptions of researches in which he endeavored to use the sulphides of metals as anodes without first subjecting them to the roasting process; this would be very desirable in practice. His experiments were made chiefly with sulphide of lead. The article is somewhat theoretical in character, and no practical conclusions seem to be drawn in the abstract.

ANALYSIS OF COPPER SLIMES. Hollard. "L'Elec.," Sept. 24.—An abstract of an article on the analysis of slimes in the electrolytic refining of copper.

DETERMINING THE STATE OF IONIZATION. Macgregor. Lond. "Elec. Eng.," Sept. 30.—An abstract of his Brit. Assn. paper on the determination of the state of ionization in dilute aqueous solutions containing two electrolytes.

CHEMICAL ACTION OF THE ELECTRIC SPARK. Berthelot. Lond. "Elec. Rev.," Sept. 30.—A brief abstract of his recent Academy paper.

ELECTRO-CHEMICAL PROCESSES AND APPARATUS.—The "Zeit. f. Elektrochemie," publishes weekly illustrated abstracts of patent specifications, including chiefly German, English, American and French patents. They are quite numerous, and will not be noticed separately in the "Digest."

CHEMICAL CONGRESS. Lond. "Engineering," Sept. 23.—Abstracts of the papers of an electrical nature, which have already been noticed in the "Digest."

MIXED SULPHIDE ORES.—"Eng. & Min. Jour.," Oct. 8.—A brief description of the Cowper-Coles electrolytic process, which has already been referred to.

DRY CELL.—"Amer. Elec.," Oct.—An article describing how to make a dry cell.

Units, Measurements and Instruments.

MEASURING HIGH VOLTAGES. Peukert. "Elek. Zeit.," Sept. 29.—After discussing briefly the various methods and pointing out the objections to the method of measuring the potential at the terminals of a fractional part of a very high resistance connected to the source, he describes another method in which these objections are claimed to have been overcome. This is also a method in which the voltage is measured on a fractional part of a circuit, but instead of using resistances he uses a series of condensers; if these are all of equal capacity, and there are condensers, then the voltage measured at the terminals of one of them will be simply one nth of the total; the voltage is measured by means of an electrometer. He describes an apparatus consisting of ten small mica condensers, each of a capacity of 0.00607 mf. The transformer system, in which the high voltage is transformed down to a low one for measurement, is a very handy one, but has the objection that the transformer ratio is in general not constant, which he shows by an example.

CORRECTION FACTOR OF WATTMETERS. Loppe. "L'Eclairage Elec.," Sept. 24.—A long, mathematical discussion of this factor, which is the coefficient by which the indicated power must be multiplied in order to give the real power. He shows how to calculate it for different conditions, including curves of other than the sine form.

QUADRANT ELECTROMETER. Elster and Geitel. "L'Eclairage Elec.," Sept. 24.—An abstract of their article describing modifications, from the "Wied. Ann.," April, which has already been noticed.

MODIFIED PRONY BRAKE. Wettler. "Elek. Zeit.," Sept. 29.—A well-illustrated description of an improved arrangement of the prony brake, the main object being to facilitate the adjustments and the taking of the readings. The brake has the usual arm to one side, at the end of which is hung a weight; another arm runs out in the opposite direction, and the end of it is attached to the lower end of a spring balance or scale; such an apparatus will come to a state of equilibrium without the troublesome adjustment of the weights; the scale measures that weight which is in excess of the weight at the other end of the arm. As the length of the lever arm of the weight changes with the deflection of the beam, a calculation is necessary, involving this deflection. The construction of the spring balance is described and illustrated in detail.

MEASURING COEFFICIENTS OF SELF-INDUCTION. Morland. "Elec. Eng.," Oct. 13.—A brief abstract of his A. A. A. S. paper, describing an apparatus. It consists of two rectangular coils, which are alike except that one is short enough to be placed inside of the other at right angles to it; in the space inside of them there is suspended a hollow conducting cylinder, which is as large as possible; it is provided with a mirror to measure its deflection. If a divided alternating current is sent through the two coils a rotary magnetic field will generally be produced, but the resistances in series with the coils may be so adjusted that no rotation is produced; in that case the self-inductions will be proportional to these resistances; one of the self-inductions being known, the other is thus determined.

SIMPLE MEASURING INSTRUMENTS. Child. "Amer. Elec.," Oct.—An illustrated article describing several forms of simple volt, ampere and watt meters, which can easily be constructed by an amateur at small cost.

Telegraphy, Telephony and Signals.

ELECTRIC BALLOON SIGNALLING. Bruce. Lond. "Elec. Rev.," Sept. 30.—A reprint of his short Brit. Assn. paper, describing the balloon invented by him. The signaller and most of the apparatus remains on the ground or the deck of the ship; the balloon contains several incandescent lights, which are flashed to produce Morse signals. For the material he prefers gold-beaters' skin; the smallest size balloon which would lift the lamps and cable is 7 feet in diameter, and has a capacity of 150 cubic feet (presumably filled with hydrogen and not illuminating gas). Through a telescope the flashes would be visible 80 or even 100 miles.

RAIL CONTACTS.—Lond. "Elec. Eng.," Sept. 30.—An illustration of one tried on an English railroad for completing signalling circuits. A wire brush is secured near the rail, pointing horizontally just across the top; it is separated from the rail by a space just equal to that occupied by the flange of the wheels, so that while a wheel is passing it connects the brush and the rail.

TELEPHONE STATISTICS FOR 1896.—"L'Elec.," Oct. 1.—A short table from the statistics of the International Bureau at Berne. Neither Great Britain nor the United States is included. In the number of subscriptions Germany heads the list with 150,481, followed by Sweden with 48,296; France, 38,854; Switzerland, Austria, Russia, etc. The number of communications per subscriber is also given, and in this Japan heads the list with 3750, followed by Austria, Germany, Russia and France.

AMERICAN TELEPHONE PRACTICE. Miller. "Amer. Elec.," Oct.—A short, illustrated article on protective devices.

Miscellaneous.

ACTION OF ELECTRICITY ON PLANTS. Cook. Lond. "Elec. Rev.," Sept. 30.—A long abstract of his Brit. Assn. paper. His experiments date back as far as 1886, and have been repeated many times; he discusses them under the head of germination, growing in the soil, and those on lower forms of plant life. Regarding the germination of seeds the general effect of a steady current was to produce an increased development, which amounted to 10 or 20 per cent.; there seems to be no difference between constant and intermittent currents; with currents from an influence machine a larger proportion of the seeds germinated, but the electrified seeds showed no increase of growth. When the current was applied to growing plants the plants matured earlier and were the first to show above the soil, but after that there appeared to be no increased rate of growth; they sprouted about four days earlier; there is, therefore, no advantage in continuing the application after the first appearance of the leaves; this applied to electricity of low tension; with high-tension currents a greatly increased rate of growth is obtained, the positive pole always producing the greater effect at first, but the negative pole rapidly caught up and took the lead; in the case of hyacinths the color produced under the negative pole was distinctly different from that at the positive or of the non-electrified plants. In comparing the effects of different kinds of currents he found that in every case the positive end of the coil produced the greatest effect with an e. m. f. of about 45,000 volts. From experiments with low forms of plant life no definite conclusions could be reached. He refers to the application of the "geomagnetifere," with which remarkable results were obtained in France; this instrument is practically a lightning conductor set up in the middle of the field and connected below with a series of cross wires running under the soil near the roots of the plants; a number of the remarkable results obtained are described; with potatoes the money value of the gain was $44 per acre. The theories to account for the action of electric currents on plants are briefly discussed, but it is thought that satisfactory explanations cannot be given until more experiments have been made.

GUTTA PERCHA. Obach. Lond. "Elec. Eng.," Sept. 30.—The conclusion of the reprint of his three Cantor lectures, which have been running through many issues of that journal.

CHANGING PEAT INTO COAL ELECTRICALLY.—"Elek. Zeit.," Sept. 29.—A brief description of a process which is said to be used in Sweden. It is followed by a calculation showing that the method is not practical, as the electrical energy required would have to be produced cheaper than it is now produced anywhere.

ELECTRIC MACHINERY AND FIRE-DAMP. Heise and Thiem. "L'Elec.," Sept. 17.—A translation in abstract of a long article noticed in the "Digest" Jan. 29, Feb. 5 and 12.

TURIN EXHIBITION.—Lond. "Elec.," Sept. 30.—The first part of a report on the electrical exhibits. It is stated that there is nothing epoch-making, but there are many improvements worth noticing. With the exception of a large exhibit from Germany, the exhibition is not really international; most of the dynamos and motors are Italian, and are of the alternating-current type, especially on the three-phase system.

ELECTROTHERAPEUTIC INSTITUTE. Collineau. "L'Elec.," Sept. 17.—A reprint of a short article describing the arrangements at the new Municipal Institute of Electrotherapy at Salpetrière.

SUPPLY OF PLATINUM.—"West. Elec.," Oct. 8.—A short article translated from a Russian journal. It appears that the platinum trade is controlled by a few British and German dealers, who buy the output up at about $100 per pound and sell it at about $250; thus both the producer and the consumer suffer. The miners are endeavoring to improve their situation.

ELECTRICITY IN MODERN SURGERY. Dickson. "El'ty," Oct. 12.—An abstract of his presidential address to the American Electro-Therapeutic Association.

DEATH BY ELECTRICITY. Hedley. "Sc. Am. Sup.," Oct. 8.—A reprint of the article noticed in the "Digest" Mar. 12 (see also Apr. 23).

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCES. Martin. "Pop. Sc. Mo.," Oct.—A long article on this Association, reviewing the historical features, the influence that it has exerted on the country, and offering some suggestions as to how this influence may be and should be increased in the years to come.

B. A. PRESIDENTIAL ADDRESS. Crookes. "Sc. Am. Sup.," Oct. 8.—The beginning of a reprint in full of his address, parts of which have already been noticed in the "Digest" and THE ELECTRICAL WORLD.

Book Reviews.

A LABORATORY MANUAL OF ELECTRO-THERAPEUTICS. By William James Herdman and Frank W. Nagler. Published by George Wahr, Ann Arbor, Mich. 163 pages, 53 illustrations. Price, $1.50.

This work is the result of various trials and experiences in electro-therapeutical work in the laboratory, and while the authors do not claim for it either perfection in the arrangement of matter or completeness in detail, they feel that the time has come for putting their plan of instruction in a form that will permit for it a wider usefulness, as well as gain for it the intelligent criticism of the experienced workers in the field which it seeks to cultivate.

Suitable batteries and other sources of electric current are thoroughly discussed in every aspect, and the various types of apparatus employed in therapeutic work are well described and illustrated. High frequency currents is a subject that receives the attention it properly deserves, and X-ray work is thoroughly gone into. A chapter is devoted to thermo-electric generators. The book no doubt will find an immediate demand in this important and rapidly extending field of application.

WIRELESS TELEGRAPHY POPULARLY EXPLAINED. By Richard Kerr, with preface by W. H. Preece. Imported by Charles Scribner's Sons, New York; 111 pages, illustrated. Price, 75 cents.

This little work is strictly up to date in that it describes the experiments recently undertaken by Signor Marconi and others, and is the first piece of literature comprehensively covering these recent developments. The induction experiments by Mr. Preece are also thoroughly described in a popular manner, and an attempt is made to locate where it belongs the much disputed credit for various developments in this new line. In this regard Mr. Preece states in the preface: "As regards Signor Marconi's position as a discoverer, it should be understood that he was the first to conceive and to patent the application of Hertzian waves to telegraphy apart from mere signaling. Branley made the first coherer, but Marconi was unquestionably the first to make the coherer into a telegraph relay."

SUBMARINE TELEGRAPHS: THEIR HISTORY, CONSTRUCTION AND WORKING. By Charles Bright. London: Crosby Lockwood & Son; 744 pages, illustrated. Price, $25.

This elaborate work on the submarine cable systems of the world was founded on an English revision of M. Wünschendorff's classic work entitled "Traité de Télégraphie Sous-Marine," with further and original data and information bringing it strictly up to date. About one-third of the work is devoted to the history of this industry, which the preface states has never been com-

prehensively presented in book form, although the capital invested is greater than in any other one branch of electrical work. The construction is described with great thoroughness and detail, and the working of cable telegraphy is discussed technically with all the modifications and details that have either been in use or show indications of future value. Among the latter are quadruplex working, Silvanus Thompson's proposed cable with inductive leak and others.

HANDBOOK OF CORLISS STEAM ENGINES. By F. W. Shillito, Jr. Bridgeport, Conn. American Industrial Publishing Company. 197 pages, illustrated. Price, cloth, $1.

This little work is not a comprehensive or technical discussion of the Corliss steam engine, but is intended for those who wish to learn how to erect, adjust and take care of Corliss engines. The first chapter is on the preparation of foundations, and others describe how to determine the reference lines, templates, how to place the main parts in position, lining and leveling and the assembling of the moving parts. Adjustment of Corliss valves and the parts of the valve gear and governor, and the taking and using of indicator cards are also described, and the work closes with nine chapters devoted to descriptions, accompanied by illustrations, of nine American makes of Corliss engines. The work should prove particularly valuable to engineers without experience in Corliss engine work, especially to young or newly graduated technical engineers who may understand thoroughly the thermo-dynamics of the Carnot cycle, but who would be utterly at sea if called upon to look after the erection of an engine.

POOR'S MANUAL OF RAILROADS; H. V. and H. W. Poor, New York, publishers. Price, $7.50.

The 1898 edition of this standard work has been issued. It contains the usual statistical summaries of the financial affairs and operations of American railroad systems. The new edition contains 1600 pages, 130 more than that of 1897. It covers the statements of about 4300 corporations, having an approximate capitalization and debt of $16,500,000,000. The department of city and suburban railways, comprising electric, cable and horse railroads, is covered by 1187 corporate statements, and contains every item of information respecting those important enterprises. Corrections are made up to August 15, 1898.

THE CURE OF WRITERS' CRAMP AND THE ARM TROUBLES OF TELEGRAPHERS AND BALL PLAYERS. By S. H. Monell, M. D. Published by J. B. Taltavall, New York; 56 pages. Price, 50 cents.

This short treatise deals with electro-therapeutics as especially applied in the treatment of lameness caused by overtaxing the muscles of the arm and hand, and the data presented are of practical, scientific interest to telegraphers, writers, stenographers and others whose occupations require continual use of arm and hand. The author seeks not only to make plain the nature and cause of the muscle fatigue dealt with, but endeavors to correct popular error regarding the curability of muscular affections and methods of treatment.

"THE ARITHMACHINIST." A practical self-instructor in mechanical arithmetic. By Henry Goldman. 150 pages; illustrated. The Office Men's Record Company, Chicago. Price, paper, $1; cloth, $1.25; leather, $1.50.

In large industrial enterprises, banks, etc., where accounts are diversified and complicated, the work of computing is necessarily onerous and exacting. This applies with particular force to electric lighting and electric power companies, many of which are practicing the most scientific methods of accounting. In work of this nature a rapid and reliable mechanical calculator would be a boon. Such a machine the "Arithmachine" is recommended to be. Full instructions for the operation of this interesting apparatus are given in this little book. The science of mechanical arithmetic is also treated in an exhaustive and interesting manner. The refinement of the science of accounting very naturally developed a demand for mechanical aids to lessen the labor, and this requirement seems to have been met in this machine.

The First Common-Battery Switchboard in New York.

The New York Telephone Company has been necessarily, on account of the magnitude of its system and the consequent cost of any changes, a little slow about adopting the common-battery system, and it is now erecting in the new Harlem exchange the first board of this kind outside of small boards used in subscribers' private branch exchanges. The new multiple board will have a capacity of about 1500 lines, and will be fitted throughout with visual signals and all the latest improvements. It will be in operation probably in about one month's time.

The Victor Express Switchboard.

In designing and constructing the Victor express switchboard, views of which are shown herewith, the Victor Telephone Manufacturing Company, Chicago, has produced one of the most perfect forms of switching apparatus mechanism on the market.

By adopting as a basis a straight metallic system with double circuit cords, and with the ringing and listening circuits normally cut out on both sides, an exchange using this board can easily be divided into metallic, common return or ground circuits, and still have each division separate from the other. Owing to the mechanical construction of the Victor express board, this can be done without any change whatever in the wiring, and as the boards are made up in self-contained sections, each of five complete drops, jacks and individual ringing keys, any section can be easily and quickly inserted or removed by even the most inexperienced person.

In Fig. 1 is shown a front view of five such sections, assembled ready for placing in position in the cabinet. The drops are arranged vertically, begin-

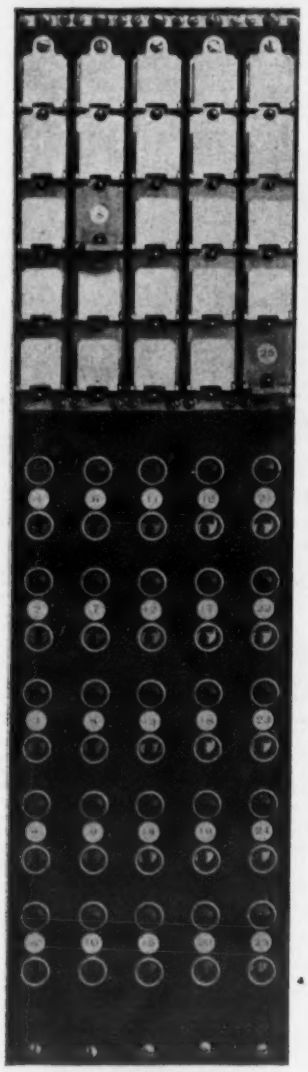


FIG. 1.

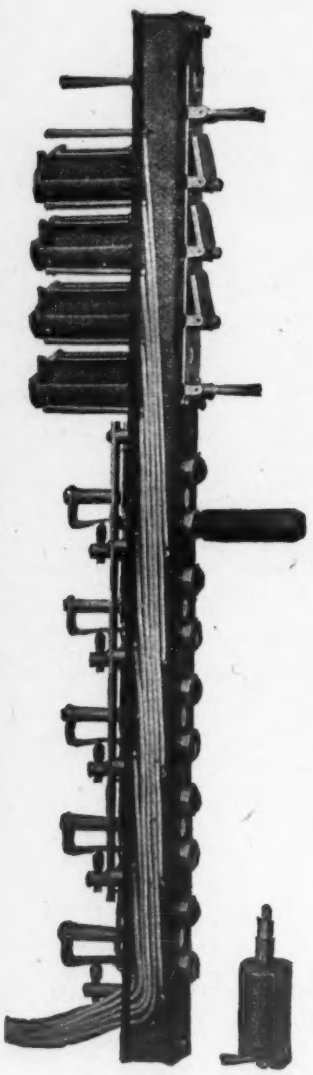


FIG. 2.

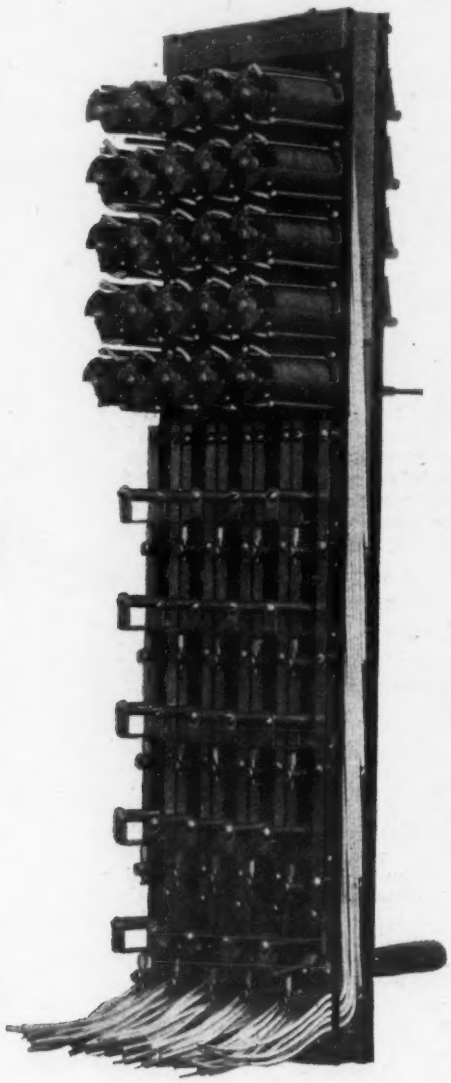


FIG. 3.

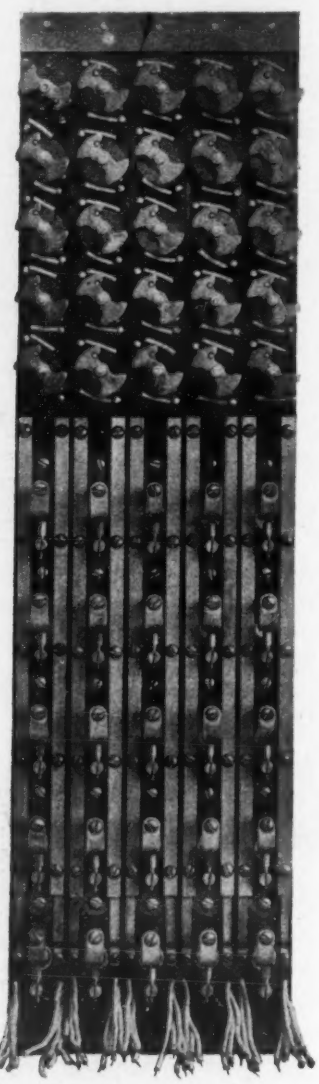


FIG. 4.

ning at the top, and are numbered in the same manner or in any other way as may be convenient.

Below the drops are placed the jacks and ringing keys, arranged in the same way. An individual ringing key is provided for each line, so that any subscriber can be called, whether the plug is in the jack or not, or if any two subscribers are connected either one can be called without ringing back on the other line.

In the side view, Fig. 2, the arrangement of drops, jacks and keys is very clearly shown, the upper coil being removed, showing the ease with which this can be done, it being merely necessary to rotate the coil one-quarter turn to withdraw it from the strip. In Fig. 3 the wiring details and the arrangement of the several parts in general are shown to good advantage. The wiring of each section is complete in itself, all wires being concealed in a vertical groove, so that when the board is connected up no wires either on the front or back are visible. All of the connections are, of course, carefully soldered, and the wires insulated with the best quality of Para rubber. Fig. 4 gives a view of the back of the board.

In the construction of the drop magnet several novel features have been employed. It is of the tri-polar type, with the armature placed so as to obtain the greatest possible force. The coils are wound in even layers with silk-covered wire, and can be removed without taking out any screws. As the coils are not in series, there is no retardation or counter e. m. f. to affect the telephone current. Consequently, to change to a toll-line jack, for very long distance work, it is only necessary to replace the drop coil with one of higher resistance.

The night-bell connection is made in such a manner that there is no metal connection between the drop coil and the shutter, leaving the coils thoroughly insulated from each other, with no possible chance for leakage of current and consequent cross-talk.

It is the claim of the Victor Company that owing to the fewness and stability of parts, economy of maintenance and lasting qualities, purchasers of this board secure a saving of 50 per cent. in the equipment of an exchange, although the first cost is no higher than that of the best board on the market.

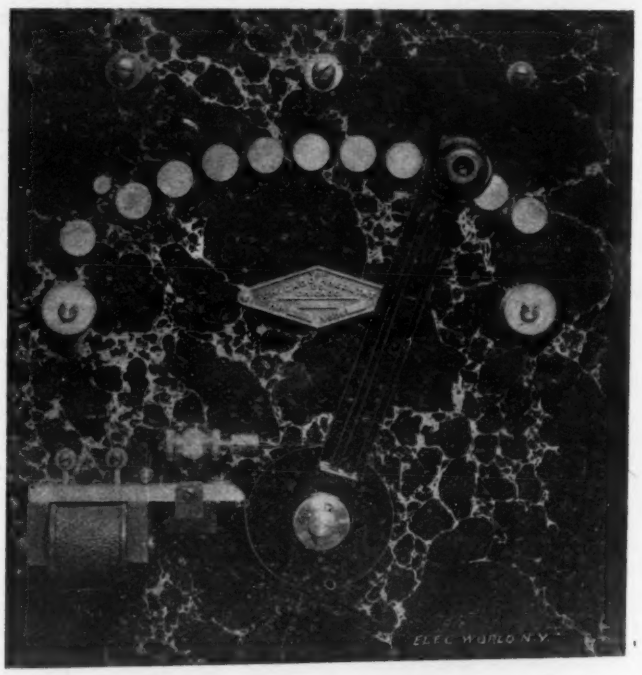
Electric Turntable.

In the article on the Erie Railroad Company's electrically driven turntable, published in the last issue of THE ELECTRICAL WORLD, an elusive typographical error made an excessive charge for current to operate the table. The monthly cost of current should have read $20, and not $200. The error was an obvious one to those familiar with such matters.

Speed-Regulating Rheostat.

The Chicago Rheostat Company's motor speed-regulating rheostat, which automatically releases the lever from any point, and cuts in the resistance when the circuit is interrupted, is illustrated herewith. The distinguishing feature is the method of clamping the lever. This is accomplished by means of a steel strap in contact with the rim of a disc on the lever, after the manner of a strap brake.

The details have been so worked out that the amount of current in the

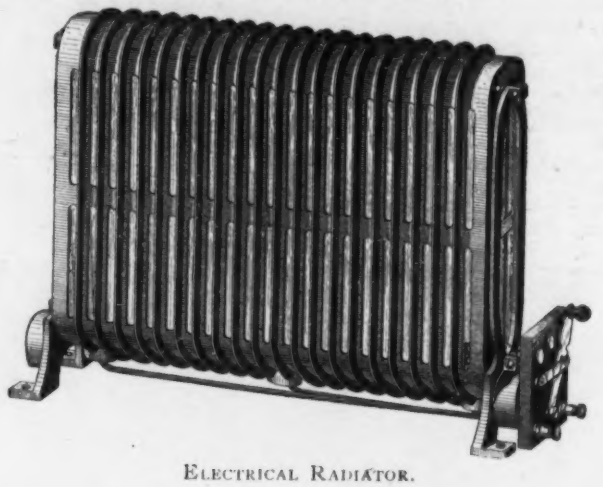


FRONT OF SPEED-REGULATING RHEOSTAT.

magnet necessary to clamp the lever is said to be much less than by any means heretofore employed. The lever is held so firmly in any position that no amount of jarring will dislodge it. It moves from point to point with great smoothness and with a total absence of jerky motion. The release is said to be positive and sure. There are no catches or notches to wear out, and a very simple take-up is employed for adjusting the tension of the strap.

A Novel Form of Electric Heater.

The Western Electric Company is placing on the market an electric heater made in the shape of a small steam radiator, as illustrated in the accompanying cut. The apparatus is 14½ inches long, 3⅜ inches wide and stands 12½ inches high, being finished in black enamel and japan. It is made for two different degrees of heat—half capacity and full capacity. The current is regulated by means of a three-point switch, shown at the right in the illustration. In one position the current is entirely off; in the second position half of the heater is used, and in the third the full current is on. The switch, besides, indicates whether the current is off, on full or on half. The heater is made for 52 and 104 volts alternating, and also for 110 and 220 volts direct current.



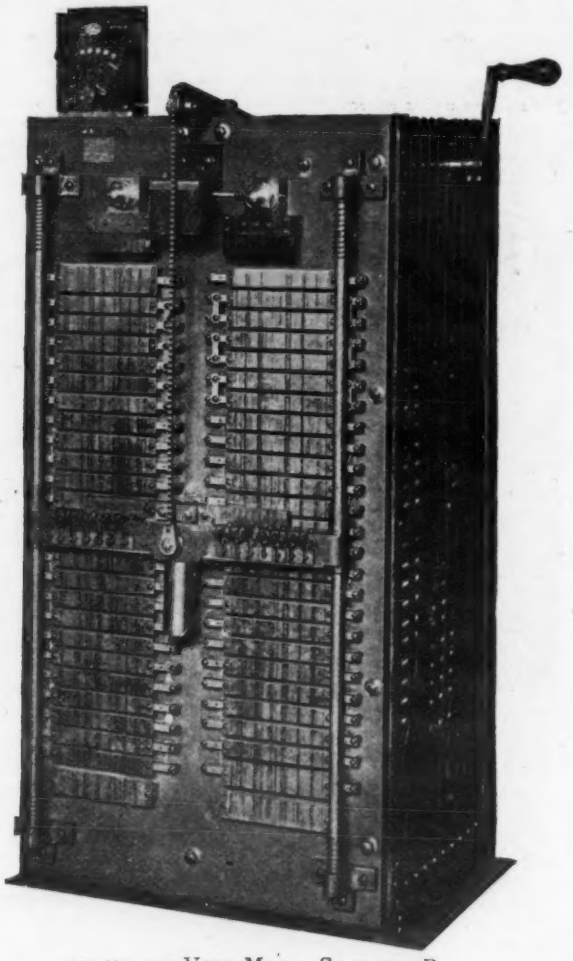
ELECTRICAL RADIATOR.

This heater will no doubt find a wide field of application in heating small offices, street railway waiting rooms, etc. It has the peculiar advantage of being instantly available, and the amount of heat can be regulated at will. No definite rule can be given to determine the amount of current necessary for heating a given space, though approximate estimates can be made by allowing from one to two watts for each cubic foot of air space to be heated, the latter amount being for well constructed buildings in cold weather.

A Large Motor-Starting Box.

The accompanying illustration shows a motor starter which is probably the largest—outside of water rheostats put up for temporary service—ever constructed.

The box is used with a 500-hp, 500-volt motor, and was made by the Cutler-



500-HP, 500-VOLT MOTOR-STARTING BOX.

Hammer Manufacturing Company, Chicago. The resistance is of wire coils attached directly without leads to the segments shown on the face. These segments are double, the surfaces, on which come the wear and tear and whatever sparking may occur, being of hard-rolled copper bolted to the segment

proper, and therefore readily replaceable. Traveling vertically over this double column of segments is the crosshead carrying the contact brushes and held in position by two rods at the sides acting as guides. The crosshead is raised by a chain and hand windlass, the crank of which is shown in the illustration, and carries switch blades, which in the uppermost position enter the clips, forming a good short-circuiting contact. The crosshead is supported in this position only by the magnet shown between the two sets of switch clips, this magnet being connected up as usual in a shunt circuit and acting as a low-voltage release. To overcome the binding of the switch blades and to start the crosshead downward springs are mounted on the upper ends of the guides and similar springs at their lower ends cushion the fall. For the sake of comparison a small 1¼-hp starting box is shown, mounted on the top of the larger one.

A Submarine Arc Lamp.

Messrs. I. E. Burdick and Franck G. Hall, Jr., students of electrical engineering at Sheffield Scientific School, Yale College, have jointly invented an arc lamp to be used in submarine work.

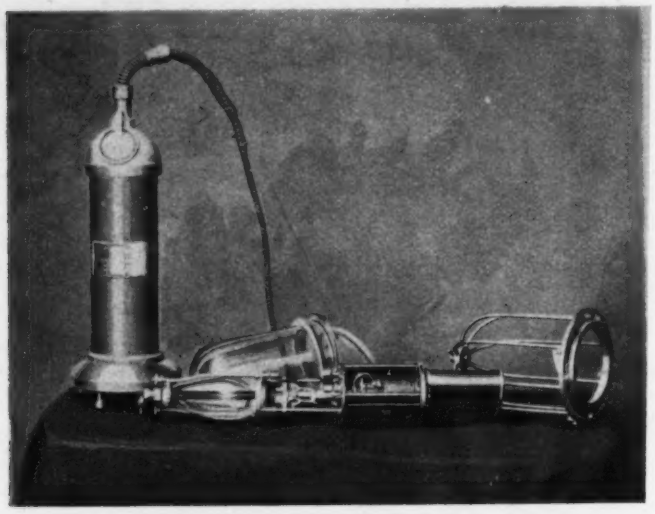


Fig. 2.—Lamp Dismantled.

These gentlemen were employed by the United States Government early last spring to conduct some electrical work in connection with the laying of mines in certain harbors on the Maine coast. At that time they conceived the idea of using arc lights under water for the examination of vessels' sides, wrecks, etc.,

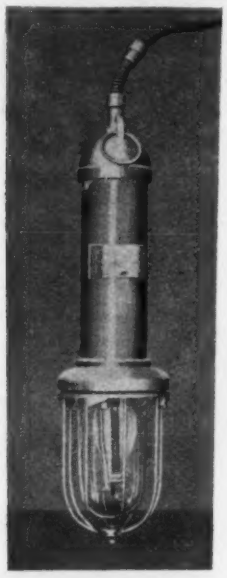


Fig. 1.—Lamp Ready for Use.

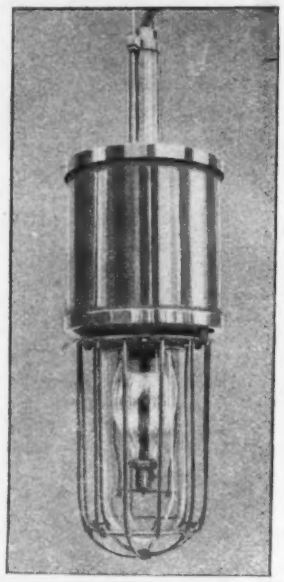


Fig. 3.—Short Submarine Lamp.

but owing to the outbreak of the war experiments were deferred. They were, however, recently instructed by the Government to conduct experiments at the Brooklyn Navy Yard, and the results of their work have, it is stated, been eminently satisfactory.

The accompanying illustrations represent the lamp, Fig. 1 showing it complete ready for submersion, and Fig. 2 showing it dismantled. Fig. 3 shows a short submarine lamp of more compact design. The lamp is of the enclosed-arc type, the mechanism being placed in a water-tight cylinder forming the upper part of the lamp. At the top of the cylinder the two insulated wires are led to the lamp. The outer globe is protected from fracture from the outside by a guard. The only joint in the lamp is at the junction of the glass outer globe and the metal cylinder. This is rendered water-tight by the use of rubber gaskets.

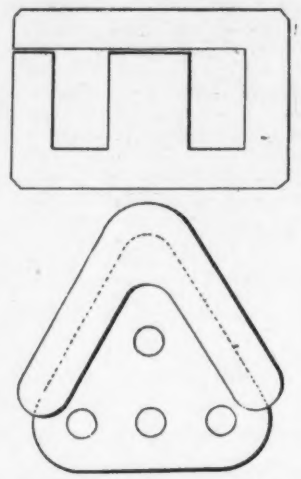
In carrying on experiments, Messrs. Burdick and Hall found that a 2000-cp lamp illuminates a spherical space in muddy water of about 20-foot radius. The tests were carried on at the navy yard at a depth of 25 feet, but it is claimed by the inventors that the lamp can be made to stand the pressures that would be encountered at any depth at which divers ever go. The question of air supply, of course, does not figure in the enclosed arc lamp, but the apparatus is provided with a valve for the release of the excess gases of combustion.

This lamp will no doubt be found very valuable and useful in laying and removing mines, disentangling cables, bridge pin construction, attaching hoisting chains to submerged guns and other movable parts of battleships; in wrecking, fishing, submarine photography in connection with Professor Dodge's aquescope, and for many other purposes in submarine work.

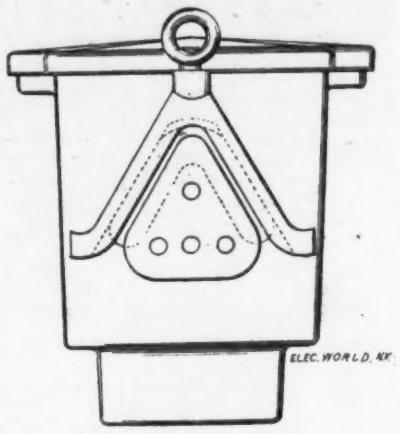
Improved Transformers.

A complete new line of transformers has just been brought out by the Royal Electric Company, Peoria, Ill. They are of the shell type, with a one-piece magnetic circuit of the usual E-shape split across one side and the tongue to allow ready stripping or assembling, as shown in the accompanying figure.

The transformers, which are designated Type E, are incased in water and oil-proof boxes. The casing is adapted for either dry or oil insulation, and gives a large surface for radiation. A very simple method of hanging these transformers has been devised by the company. The support consists of a small triangular plate having a projecting shoulder, and may be separately attached to the pole, cross arm or wall by lag screws. Upon the back of the



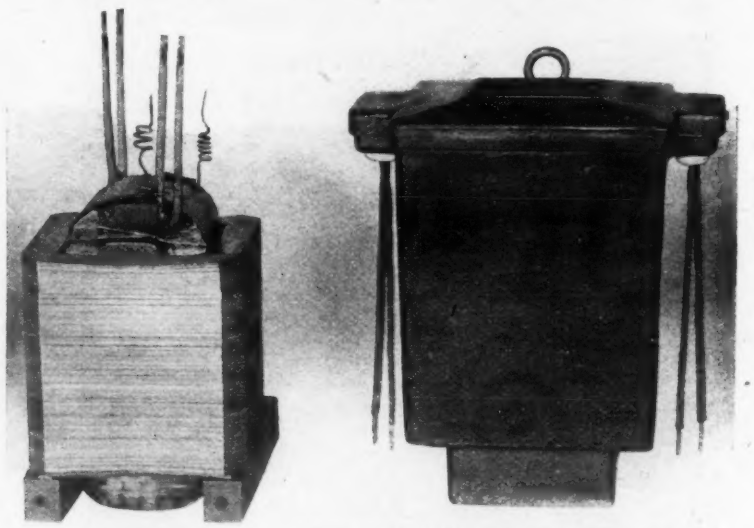
Core Stamping and Hanging Plate.



Transformer Supported on Hanging Plate.

transformer case is an inverted V-shaped channel or slot, which corresponds in shape to the plate. To place the transformer in position it is simply raised and slid over the projecting rim of the plate.

No terminal plate is used within the transformer, and but two leads come from the secondary, the proper connection for 50 or 100 volts being effected within the case. To avoid the liability of mistakes one end of each of the two



Assembled Coils and Perspective View of Transformer.

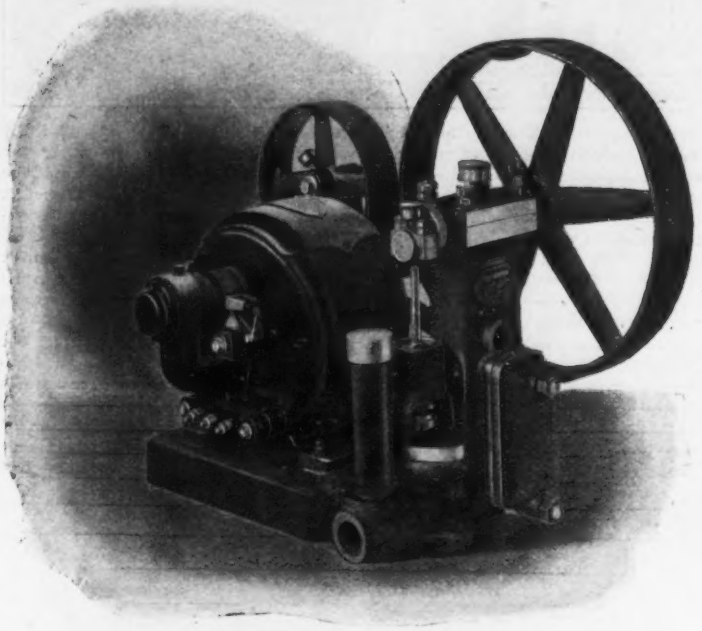
secondary coils is painted black and the other red. All four leads emerge vertically downward through porcelain bushings under the eaves of the cover.

A Compact Pumping Combination.

A neat and compact pumping outfit for house tank and similar service has recently been put out by Henry R. Worthington. The pump is of the type which is in use for a great variety of purposes, but is especially designed to supply the reservoir tanks of high office buildings and residences, where the pressure carried in the city mains, insufficient to elevate water above the lower stories, must be reinforced by pump pressure. The motor is connected to the pump by belt, and with no cut gears intervening the operation of the pump is noiseless.

The motor is of the C. A. type—a type designed and manufactured by the General Electric Company to meet a demand for motors adapted to the direct application of power to small machines. It is built in capacities of 2, 1, ½ and ⅛ horse-power. The first three are wound for use on 115, 230 and 500 volt circuits, the ⅛-hp machine being wound for 115 volts only. They are light and compact and occupy very little floor space, while they may, by a single change

in the position of the bearings, be run in any position. The magnetic circuit is of laminated, instead of cast iron, the armature of toothed laminations with coils made up and insulated before application. The motor is mounted upon the base of the pump, making the combination one of the most compact on



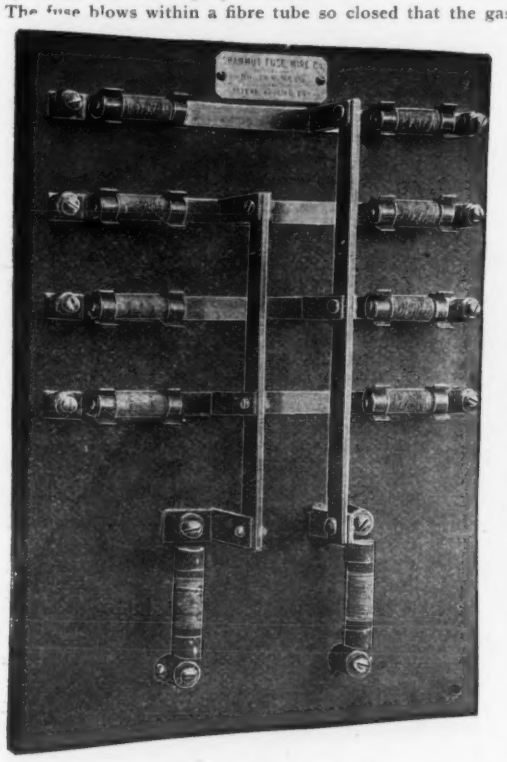
PUMP DRIVEN BY AN ELECTRIC MOTOR.

the market. It is stopped and started by an automatic switch operated by a float on the water in the tank. These pump combinations are built for capacities of 200 and 500 gallons as required.

Shawmut Enclosed-Fuse Tablet Boards.

Electrical engineers have been looking for a line of tablet boards which would be compact and neat, and at the same time avoid all possible fire risk. To do this it was essential that fuses be made in such a manner that upon blowing there would be no arcing, flashing or undue heating which could set fire to inflammable material near by. The illustration shown represents the efforts of the Shawmut Fuse Wire Company, of Boston, Mass., to make a combination tablet and enclosed fuse board that would answer these conditions in the most satisfactory manner. To do this it was necessary to experiment largely in a new line; and the company now offers to the trade a board that can be manufactured at a very reasonable price and at the same time cover all the necessary conditions for its proper action.

The fuse blows within a fibre tube so closed that the gases and heated metal



ENCLOSED-FUSE TABLET BOARD.

cannot escape. The ferrules make contact similar to the blade of a knife switch, thereby avoiding the use of tools when fuses are placed. This manner of replacing a fuse will be appreciated by those who have been obliged to place fuses in a small space with a large amount of bare metal in close proximity.

This device has been approved by the National Board of Fire Underwriters and the Shawmut Fuse Wire Company feels that it will be greatly appreciated by engineers and architects generally.

Receptacle and Midget Plug.

The accompanying illustrations show a receptacle and a plug and receptacle of improved form which no doubt will be favored by electrical workers. Not the least feature is the small size of both of these devices. The receptacle shown in Fig. 1 is made of one piece of cylindrical porcelain 1¾ inches in diameter by 1¾ inches deep. The plug is fusible. The only tool necessary to install this receptacle is a common auger-bit.

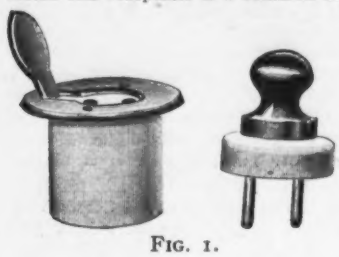


FIG. 1.

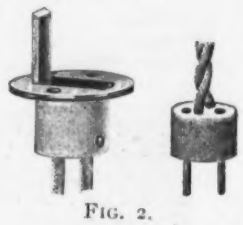


FIG. 2.

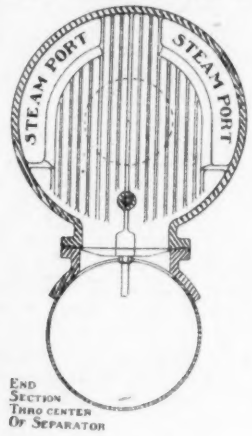
The "Midget" plug and receptacle shown in Fig. 2 is designed for use in confined spaces. It is made of porcelain throughout, except the face plates, and will carry a maximum of ten amperes, and is not fused. The face plates are furnished to match any finish of hardware.

These compact devices are made by the Anchor Electric Company, 71 Federal Street, Boston, Mass.

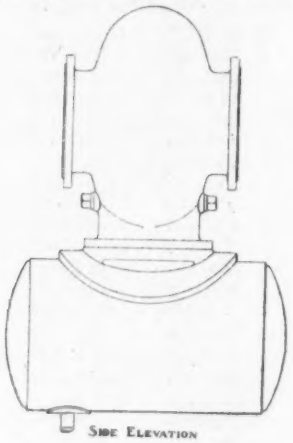
A Horizontal High-Pressure Separator.

The accompanying illustrations represent a special 18-inch horizontal high-pressure Cochrane separator, built by the Harrison Safety Boiler Works, Philadelphia, Pa., for the Cambria Iron Company, of Johnstown, Pa. On account of the limited space between the main steam pipe and the floor it was necessary to turn the well or receiver at right angles, thus giving the desired capacity without increasing the depth. The specifications calling for a separator adapted for an exceptionally high working pressure (250 pounds per square inch), a large factor of safety was adopted and the metals proportioned accordingly. The thickness of the metal in the shell forming the head of the separator was made 1¼ inches, with flanges 2½ inches thick. The well, 30 inches in diameter by 4 feet 9 inches long over heads, was made of flanged steel seven-sixteenths of an inch thick, with horizontal joint lap and triple riveted, the heads, nine-sixteenths of an inch thick, being dished to a 30-inch spherical radius. For the drip a 2½-inch reinforced tapped opening was provided; the cast-iron saddle was double riveted to the shell, and the same suitably bolted to the head proper.

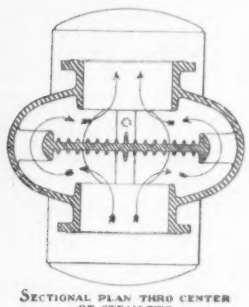
In the use of an oblate spheroidal shape exceptional strength was given, with special protection at the juncture of the lower branch with the head on the short axis from expansion and contraction strains, by means of a stay tube cast in with the head. Through this stay tube is passed a 1 5-16-inch bolt fitted at each end with a close ended steel nut. The following are the principal dimensions of the separator: Greatest diameter across the head, 4 feet; distance from the bottom of the well to the top of the head, 7 feet; weight, 5400 pounds. The completed separator was hydraulically tested under a pressure of 400 pounds per square inch.



END SECTION THRO CENTER OF SEPARATOR



SIDE ELEVATION



SECTIONAL PLAN THRO CENTER OF STEAM PIPE

PERSPECTIVE AND SECTIONAL VIEWS OF 18-INCH HORIZONTAL SEPARATOR.

NEWS OF THE WEEK

Financial Intelligence.

THE EDISON ELECTRIC ILLUMINATING COMPANY, of Boston, report gross earnings during the six months ended June 30 last $488,964; operating expenses, $306,851; net earnings, $182,113.

THE BOSTON ELECTRIC LIGHT COMPANY.—In the last issue of THE ELECTRICAL WORLD it was stated that a regular quarterly dividend of 1½ per cent. had been declared, payable December 15. This date is erroneous. It should have read October 15.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has furnished the New York Stock Exchange with a balance sheet dated July 31, 1898, which is as follows:

ASSETS.		LIABILITIES.	
Cash	$152,732	Accounts payable	$559,683
Bills receivable	115,596	Bills payable	2,744,894
Accounts receivable	2,157,795	Dividend scrip	194,560
Material in stock	1,872,019	U. S. Elec. Light Co. bonds.	300,000
Sawyer-Man Elec. Co.	785,253	Collateral trust bonds	590,000
Real estate, etc.	1,529,557	Preferred stock	3,996,750
Machinery, tools, etc.	1,374,542	Assenting stock	8,227,475
Stocks and bonds	5,846,086	Common stock	146,700
Patents, charters, etc.	4,763,785	Surplus	2,191,322
Miscellaneous	354,019		
Total assets	$18,951,384	Total liabilities	$18,951,384

Special Correspondence.

NEW YORK NOTES.

Office of THE ELECTRICAL WORLD,
9 Murray St., NEW YORK, October 17, 1898.

MR. WILLIAM SUTTON, president of the American Car Company, of St. Louis, is at present in New York on business. He and Mr. E. J. Lawless, the Eastern representative of the company, have lately been closing some nice orders for cars.

MR. HIRAM S. MAXIM, the well-known inventor, was arrested at Poughkeepsie last week on the charge of bigamy and abandonment, preferred by a woman calling herself Helen Maxim. The charge of bigamy has been withdrawn, but the abandonment proceedings will be prosecuted. An adjournment in the case was taken until Friday of this week. Mr. Maxim is under bail.

THERE HAVE BEEN no new developments in the plans of the New York Gas, Electric Light, Heat & Power Company, whose incorporation was noted in this column in last week's issue, and those indirectly interested are still guessing at what the new company proposes to do. One of the latest theories is that the new company, counting upon its close relations with city officials, will proceed to install a large plant in opposition to all of the old companies and then precipitate a fight on rates in order to rapidly extend its business, and finally secure control of the whole lighting situation, as was done in Brooklyn recently by the Kings County Electric Light & Power Company. In this connection it should be noted that President H. H. Vreeland, of the Metropolitan Street Railway Company, denies the report to the effect that his company intended to sell electric current in any form. He states that the Metropolitan Company is prohibited by its charter from doing anything of the kind. The week, therefore, closes without anything more definite being revealed than was given in the last issue.

A NEW TELEPHONE COMPANY.—A surprise was given to the public last week by the announcement of the incorporation of the People's Telephone Corporation at Albany last Wednesday, with a capital stock of $5,000,000. The following named gentlemen are the officers: President, Darwin R. James; vice-president, Elias S. A. Delima; secretary, Frank S. Gardner; treasurer, Silas B. Dutcher. The company will operate lines of telephone from this city to points within the United States and Canada. The directors are S. B. Dutcher, J. E. Nichols, E. S. A. Delima, Francis C. Travers, Frank Brainard, J. Fred Ackerman and Darwin R. James, of New York City. The preferred stock will be entitled to an 8 per cent. dividend, which shall be cumulative before any dividend on the common stock shall be declared, and the preferred stock is subject to redemption by the corporation five years from the date of issuance thereof, at $110 a share. The incorporators of the company besides the directors are: S. Cristy Mead, Lee Kohns, Ludwig Nisson, William P. Wiley, James G. Johnson, Washington Winsor, Edward L. Molineaux, E. A. Cruikshank, B. Fischer, Milton Knapp, Charles J. Gillis, J. Fred Ackerman, Eugene H. Conklin, Martin Schrenkeiser, Jere Pangburn, Jr., George Thompson and Alfred Paradis, of New York City, and Frederick Potter and E. A. McAlpin, of Sing Sing. Each of the directors and corporators subscribes for $1,200 of the stock of the company. While this new corporation expects to devote its energies mainly to telephone service, the certificate of incorporation says that a telegraph system may also be constructed and operated by the company. President James and Secretary Gardner, of the new company, are president and secretary, respectively, of the Board of Trade and Transportation, whose headquarters are at 203 Broadway. To a representative of THE ELECTRICAL WORLD Secretary Gardner stated it was the intention of the company to give a public demonstration of the system and apparatus to be used, for the purpose of satisfying any misgivings that may exist as to the practicability, general utility and commercial value of the project. He said that while the plans of the company involve the use of principles now utilized and well understood by the electrical public, at the same time new methods and new devices would be employed. Assurance was also given that in the near future readers of THE ELECTRICAL WORLD would be furnished with full information regarding the system in all its details. It is stated that the new company will in a year compete actively with the Bell Company, and will make a charge for unlimited service in Manhattan of $100. This will include the right of free use of its public pay stations for 100 calls per annum per subscriber. The message service rates will be made $40 for 400 messages, and for a larger number of messages on the message schedule the rate will go as low as 4 cents per message. The residence message rate for service on private wires will be $30. To families living in apartment houses and flats an unlimited service connecting with all the other subscribers of the company will be given for $1 per month on group lines. The unlimited service for business places in Brooklyn will be $75 per year. Mr. Gardner states that the new company has all the needed rights to engage in active business. Members of the board of directors claim that with a capital of $5,000,000 the company can serve 40,000 subscribers.

NEW ENGLAND NOTES.

Branch Office of THE ELECTRICAL WORLD,
Room 91, Hathaway Building, 620 Atlantic Ave.,
BOSTON, Mass., October 15, 1898.

MR. FRANKLIN B. PLATT, secretary of the Ansonia Electrical Company, Ansonia, Conn., was a Boston visitor this week.

THE ANCHOR ELECTRIC COMPANY, Boston, has engaged the services of Mr. H. G. Issertel, formerly of the Walker Company, as traveling representative, with headquarters in New York City, where the Anchor Company will soon open an office.

THE AMERICAN ELECTRICAL WORKS, Providence, R. I., through the distribution this week of a group photograph of its 1898 clambake, will make particularly happy those of its friends who attended the event. There were over 300 persons present, this being the largest number at any of the company's bakes. The group photograph this year is the best ever distributed.

MR. SAMUEL H. COUCH, of Whitman & Couch, Boston, the well-known telephone manufacturers, was united in marriage at Roxbury, Mass., Tuesday evening, October 11, to Miss Elizabeth Coleman, of New York. Immediately after the marriage, which was private, only intimate friends being present, Mr. and Mrs. Couch departed on a brief wedding trip, and on their return will reside at No. 55 Humboldt Avenue, Roxbury. Mr. Couch has a large circle of friends in the telephone and electrical business, the congratulations and best wishes of whom, our own included, attend him and his bride for the fullness of happiness and prosperity.

THE TWENTIETH TRIENNIAL EXHIBITION OF THE MASSACHUSETTS CHARITABLE MECHANICS' ASSOCIATION was opened to the public on Monday evening last. There is quite a number of purely electrical exhibits and others of indirect interest to electrical people. A brief reference to these exhibits will no doubt be of interest at the present time, leaving a more detailed account for the future.

MR. J. H. WILDAY, 23 Duane Street, New York, illustrates the art of engraving by electricity.

THE EATON ELECTRIC MOTOR CARRIAGE COMPANY, Boston, Mass., exhibits an electric motor carriage.

THE ELECTRIC DISPLAY COMPANY, 27 School Street, Boston, makes an exhibit of electrical display advertising.

THE JOHN A. ROEBLING'S SONS COMPANY, Trenton, N. J., shows a sample board of electrical wires and cables.

MESSRS. WHITMAN & COUCH, 196 Summer Street, Boston, make an interesting exhibit of telephones and telephone appliances.

THE LOMBARD WATER WHEEL GOVERNOR COMPANY, Boston, exhibits a Lombard water wheel governor in practical operation.

THE HOLTZER-CABOT ELECTRIC COMPANY, Boston, Mass., makes a display of a large variety of electrical apparatus, including several novelties.

THE POPE MANUFACTURING COMPANY, Hartford, Conn., exhibits a Columbia motor carriage. This is the first time this carriage has been seen in Boston.

THE MAXHAM ELECTRIC THIRD-RAIL COMPANY, 606 Tremont Street, Boston, has an exhibit of its system, which is particularly interesting to railroad men.

THE JANDUS ELECTRIC COMPANY, Cleveland, Ohio, is represented by Mr. H. T. Edgar, New England agent, whose headquarters are at 524 Tremont Building, Boston.

THE SAMSON CORDAGE WORKS, Boston, make an interesting exhibit of their varied lines of manufactures, including braided cord in a variety of sizes, materials and colors.

THE RIDGWAY DYNAMO & ENGINE COMPANY, Ridgway, Pa., through its Boston agency, has an exhibit of a 75-kw dynamo directly connected to one of its engines.

GREAT INTEREST centres in the beautiful decorated parlor, which is lighted by the Moore vacuum tube system. The current from the street mains of the Edison Electric Illuminating Company is used.

AN ARTISTIC and popular exhibit is the wax tableaux illustrating some

of the successive stages of electrical development. These were prepared by Dr. Park Benjamin, Prof. F. B. Crocker and Mr. T. C. Martin.

THE STANDARD THERMOMETER & ELECTRIC COMPANY, Peabody, Mass., lights the gallery of the exhibition hall by its well-known arc lamps. Its thermometers are also placed in various parts of the building.

THE DIESEL MOTOR, which is attracting so much attention in the mechanical world, is here exhibited for the first time in New England. This remarkable machine was described in THE ELECTRICAL WORLD of May 28, 1898.

THE RIKER ELECTRIC MOTOR COMPANY, Brooklyn, N. Y., has an exhibit of a line of automobiles. This company's delivery wagons are used in New York City by several leading houses, and others are building for prominent Boston houses.

THE INCANDESCENT ELECTRIC LIGHT MANIPULATOR COMPANY, Hyde Park, Mass., brings to public attention a device for the safe and convenient handling of incandescent lamps. It is designed to remove bulbs from their sockets in high and inaccessible situations.

THE BURTON ELECTRIC SMELTING COMPANY, 144 Lincoln Street, Boston, makes a practical demonstration of electric metal working and smelting. This exhibit consists of a direct-current welding, forging and brazing machine. A welding machine was illustrated and described in THE ELECTRICAL WORLD of August 27, 1898.

THE GENERAL ELECTRIC COMPANY'S exhibit consists of the 25-foot globe—a miniature representation of the earth—which formed so conspicuous a feature among the exhibits at the recent convention of the American Street Railway Association in this city. A description of this unique exhibit was given in THE ELECTRICAL WORLD of September 17, 1898.

THE NEW ENGLAND TELEPHONE & TELEGRAPH COMPANY has a unique and interesting display of apparatus which is intended to demonstrate the business and social use of the telephone. Through the courtesy of Mr. B. F. Keith connection will be made with the exhibition telephone system, and patrons of the fair will enjoy the privilege of listening to the distant performance.

THE UNITED STATES ELECTRICAL SUPPLY COMPANY, 141 East Twenty-fifth Street, New York, makes an extensive exhibit, including, besides its acetylene gas generator, a thermo-electric generator. The Clarke wireless telegraphy and the X-ray exhibits of this company form two of the principal attractions of the fair. By means of the wireless method of transmitting electric waves submarine torpedoes are exploded four times a day in an artificial lake placed on the stage.

THE EDISON ELECTRIC ILLUMINATING COMPANY, of Boston, occupies a space of about 2184 square feet, which is divided into three sections. The central section or archway is devoted to a display of ornamental incandescent lighting by means of miniature lamps. In one of the side sections are exhibited incandescent and arc lamps, a photometer and a prepayment meter, also the company's standard meters. In the third section is exemplified the application of electrical power to the running of direct-connected machinery and the use of electricity for cooking and heating.

PHILADELPHIA NOTES.

Branch Office of THE ELECTRICAL WORLD,
929 Chestnut Street,
PHILADELPHIA, Pa., October 17, 1898.

MESSRS. FRANK H. STEWART & CO., 35 North Seventh Street, have just brought out their 1899 catalogue of electric light supplies. The catalogue is very fully illustrated with cuts of goods of this class, and the line handled by Messrs. Stewart & Co. is a very complete one. All of the goods handled by the firm are of standard make and type.

MEETING OF THE FRANKLIN INSTITUTE.—At the stated meeting of the institute, which will be held on Wednesday evening of this week, Mr. Edward H. Johnson, vice-president and general manager of the Sprague Electric Company, New York, will read a paper on the Johnson-Lundell surface contact system of street railway. The paper will be fully illustrated.

BUFFALO AND NIAGARA FALLS NOTES.

BUFFALO, N. Y., October 15, 1898.

MR. P. H. GRIFFIN, proprietor of one of the largest car-wheel works in Buffalo, has a large interest in the new electrical plant soon to be erected at Shawinegan Falls, 19 miles from Three Rivers, Quebec.

THE GENERAL ELECTRIC COMPANY is engaged in drawing in the cable in the Niagara Street subways that will make the entire Niagara power line an underground system so far as Buffalo is concerned. As soon as all the cable is in position the city terminal house at the foot of Potomac Avenue will be discontinued and the new one at the city line put into use. The cable is of the same three-conductor pattern as the one now in use, and is about 13,000 feet long. The old pole line will be disconnected, but maintained as an emergency line.

THE ANNOUNCEMENT, made some months ago, of the establishment of an electric button factory at La Salle, on the line of the Niagara power current to Buffalo, is at last confirmed, though for a time it was supposed that the project had fallen through. On October 11 the contract for a four-story brick building, 40 by 100 feet, with two-story boiler and dry house attached, was let. The works will not be a branch of J. B. Shantz's factory in Berlin, Canada, as has been stated, nor of the one under management of J. H. Shantz & Son, in Buffalo, but will be a separate venture. The people interested in it are mainly the same, however. They will say very little as to the equipment of electrical apparatus, but admit that they expect to be running next spring.

THE DEPEW & LANCASTER POWER COMPANY is actively engaged in getting the right of way for the pole line to carry the Niagara current to these eastern suburbs of Buffalo. Considerable difficulty has been experienced and some of the land has been taken by commission. It is not the intention to build an independent line all the way to Niagara Falls, but to join the one to Buffalo, either in Tonawanda or south of it, thus avoiding a second set of poles from that point northward. A transformer station will be built in Depew as soon as the line is ready. The company is not prepared to announce any contracts for the use of the current, but says that there is a reasonable amount of assurance that there will be patrons in plenty as soon as the power is ready to deliver.

THE NEW Buffalo & Lockport trolley line is given a very high character by the management. The passenger cars make a mile a minute where it is permissible, which is sometimes necessary in order to make the time. The trip of 25 miles is made in 73 minutes, though half of the time is taken for running through Buffalo and Tonawanda. The electric freight engines are easily hauling thirty-five cars and performing all the work of the steam locomotives which they supplanted. Manager Van Horn states that the 800 horse-power that was put into the motors is not considered too much, though it is in excess of such motor engines generally. The road has this week taken formal possession of the Kenmore line from Buffalo to Tonawanda, and will change the route to that via Main Street, Buffalo, instead of following the Niagara Falls line of the company via Niagara Street. It is not expected that the time can be shortened by the change, but the city will in this way be covered better by the two lines, as they come together again in Tonawanda.

MILWAUKEE NOTES.

MILWAUKEE, Wis., October 18, 1898.

WINNEBAGO CITY, MINN., is contemplating the establishing of a city lighting plant.

THE OFFICERS of the Milwaukee Electric Railway & Light Company recently entertained the officers of the Chicago street railways. Messrs. Henry C. Payne, Charles F. Pfister, General Manager Biggs, Superintendent Mitten, Chief Electrician Rau and Comptroller Mackay were the hosts.

AN EXTENSIVE glue manufacturing plant is being erected near South Milwaukee for the United States Glue Company. All the machinery will be electrically driven. About 500 horse-power will be used. Mr. Philip Bossert, of the Pfister Vogel Leather Company, of this city, is drawing up plans and specifications for the electrical plant.

THE WISCONSIN TELEPHONE COMPANY announces to its patrons that a new branch exchange, located on the lake side, will shortly be opened. It will be known as the "Lake" Exchange. This branch, with those already in operation on the west, south and north sides, completes the chain of branches, established with a view to reducing distances and rates to the minimum as far as possible within the city limits. The reduction in rates to subscribers in the northeastern portion of the city amounts in the aggregate to sums ranging from $5 to $80 per year per subscriber. The residents of the Lake Park district will benefit greatly by the saving of 2 miles of distance charge.

ST. LOUIS NOTES.

ST. LOUIS, Mo., October 14, 1898.

CHANGE OF POWER.—The Oliver Street line, part of the Lindell system, has a bill in the City Council to change its motive power from cable, which is now being used, to the overhead trolley system.

THE KINLOCH 'PHONE SERVICE.—The merry war of the telephone companies will soon be on if the management of the Kinloch Company fulfills its present expectations as to placing its system in operation. At the office it has been stated that the new system will positively be in operation before the end of the present month.

THE CIRCUIT COURT decided this week that, in the suit of L. M. Rumsey against the People's Railway Company, in which Rumsey asked that a receiver be appointed, as the interest on the third mortgage bonds has been defaulted, the road must be sold, and he instructed the attorneys at some length, in his verbal opinion, to draw up a decree of sale. He also stated that the charges made against Receiver L. M. Rumsey and the ex-president, Charles Green, whom it was claimed had done all they could to wreck the property, were not true. It is likely that the disposal will be made by auction to the highest bidder.

THE BILL granting the Lindell Railway Company the right to consolidate all its various lines and to connect them by tracks over intervening streets was reconsidered this week by the City Council, after it had been defeated at a former session, and passed. The bill amounts to the granting to the Lindell of a new franchise, running until 1942 over all its roads. The remuneration is to be $14,000 for each of the two first years, $28,000 for the next five, $32,000 for the next ten years, 3 per cent. of the gross earnings for the next ten years, 3½ per cent. for the next eight years and 4 per cent. for the remaining ten years. Transfers, which amount to a universal transfer system over that line, are to be given at various points. The bill will now go to the House of Delegates, where a similar one has been defeated during the past month.

PACIFIC COAST NOTES.

SAN FRANCISCO, Cal., October 9, 1898.

THE CITY OF FRESNO, CAL., is seriously considering the question of establishing a municipal electric lighting system.

THE ELECTRIC RAILWAY & MANUFACTURERS' SUPPLY COMPANY, of San Francisco, was recently incorporated. The directors are: William F. J. Boure, Samuel H. Taylor, Frank Frisbie and Henry P. Howie. The capital stock is placed at $50,000.

THE SUNSET TELEPHONE & TELEGRAPH COMPANY has announced the completion of its Pacific States telephone lines, including the 400-mile gap between the Oregon and California systems, the line from Walla Walla, Wash., to Huntington, Ore., and one from Spokane, Wash., to the British line.

THE PORTLAND (Oregon) City Council has awarded to the Portland General Electric Company a contract for lighting the streets for a period of two years, from April 1, 1899, at the rate of $7.57 a month per arc lamp and $1.50 a month per incandescent. Under the present contract with the same company the city lighting costs about $85,000 a year.

IT IS reported that a San Francisco syndicate, headed by H. E. Huntington, has acquired the San Mateo Street Railway and the street railway franchise covering many streets in Los Angeles, owned by J. C. Kays. The same gentlemen recently purchased the Los Angeles Railway Company's street railway lines. I. W. Hellman, of the syndicate, recently said that he did not think they would acquire the Santa Monica and Pasadena electric railways, which had been reported as sold.

THE CENTRAL LIGHT & POWER COMPANY, San Francisco, is installing two additional generators to be driven by a 750-hp triple-expansion, vertical, Union Iron Works engine. Two cooling towers are being installed by Charles C. Moore & Co. on the roof of the Parrott Building, in the basement of which the central station is located. The towers are placed 100 feet above the level of the street. Additional boilers and condensing apparatus will be installed. Siemens & Halske generators are used exclusively.

CANADIAN NOTES.

OTTAWA, ONT., October 15, 1898.

THE CITY ENGINEER of Toronto, Ont., has refused to draw up specifications for a 6000-hp municipal power plant, as ordered by the City Council, and has recommended that $1000 be appropriated to secure the services of an expert consulting electrical engineer who would draw the specifications.

A UNITED STATES COMPANY, which is going to develop the water power of the Jacques Cartier River, in the Province of Quebec, for electric light and power purposes for Quebec city, in opposition to the Montmorency Company, has acquired the chartered rights, as regards the city of Quebec, of the Standard Light & Power Company, of Montreal. The American company has a capital of $500,000, and its president is Mr. Emerson McMillan, of New York.

A LARGE POWER DEVELOPMENT.—Messrs. Barry, Ross & McRae, contractors, of Niagara Falls, Ont., have secured the contract for the construction of the central power house, for the development of 30,000 horse-power at Shawinegan Falls on the St. Maurice River, near Three Rivers, Que. This, it is said, will be the largest power development in Canada. The plans of the Shawinegan Company and other information concerning the enterprise were given in this correspondence in THE ELECTRICAL WORLD of September 10 last.

ALTHOUGH it is only a few years since the first electric railway was built in Canada, it is now possible to obtain in the Dominion all the materials necessary for the complete equipment of an electric road. In the case of the street railway recently completed at St. Thomas, Ont., with the exception of the overhead fixtures, the line was built and equipped with Canadian material, the total cost being $85,000. The rails were made at Hamilton, Ont., the engines at Amherst, N. S., dynamos and electrical equipment at Peterboro, Ont., and the cars at Ottawa.

THE WEST KOOTENAY POWER & LIGHT COMPANY, which is building a parallel line of wires between Rossland, B. C., and the generating plant at Bennington Falls, has the right of way cut, and poles on the ground for most of the distance. The right of way has been cut clear of everything for a width of 100 feet, and all the tall trees outside of that area, which, if they fell, would injure the line, have also been cut down. The insulators will be housed, so as to keep out the snow in winter. The idea in constructing the second line is that if one line goes down the other can be made use of and interruption of the service prevented.

MONTREAL, Que., October 15, 1898.

THE ELECTRIC RAILWAY from Ridgetown to Rondeau Park, near Chatham, Ont., is one of the probabilities of the near future.

THE PETERBORO & ASHBURNHAM STREET RAILWAY has been sold to Arthur Stephenson, and it is probable that some improvements will be made.

THE RATEPAYERS OF BARRIE, ONT., recently voted a by-law to raise $35,000 for the installation of a municipal electric light plant. Tenders for the plant were taken some weeks ago.

A NEW incandescent electric lighting plant is to be installed at Campbellford, Ont., for which $8000 was recently voted by the ratepayers. The new plant will replace the one now in use.

THE HAMILTON, ONT., City Council has extended the franchise of the street railway company for fifteen years. As soon as financial arrangements are completed some improvements will be made in the system.

ELECTRIC RAILWAYS IN NOVA SCOTIA.—There is a movement in favor of building an electric railway from Waverly to Dartmouth, N. S., thence to Musquodoboit Harbor. The promoters will hold a meeting in a short time.

THE PARIS ELECTRIC LIGHT & POWER COMPANY, Brantford, Ont., represented by Messrs. Carroll & Smith, has asked permission to distribute electric power in that city. The company proposes to utilize the water power of the Grand River, and will build a dam.

ADVICES from St. Catharines, Ont., state that Messrs. Haines Brothers, of New York, who have secured control of the Niagara Central Railway, announce their intention of operating the road by electricity. Various changes in the roadbed will be made, and the trestle work at Merritton and Thorold will be done away with.

ENGLISH NOTES.

(From Our Special Correspondent.)

LONDON, October 5, 1898.

MUNICIPAL TELEPHONE LICENSE.—The Glasgow Corporation has received an intimation to the effect that the Postmaster-General is prepared to grant it a license for a telephone exchange on its securing the necessary powers from Parliament, which license would expire on December 31, 1911, at the same time as that of the National Telephone Company. The experiment of a public telephone service established by a municipality will be watched with interest on both sides of the Atlantic.

THE NATIONAL PHYSICAL LABORATORY.—In August last year a committee was appointed by the Treasury "to consider and report upon the desirability of establishing a national physical laboratory for the testing and verification of instruments for physical investigation; for the construction and preservation of standards of measurement, and for the systematic determination of physical constants and numerical data useful for scientific and industrial purposes, and to report whether the work of such an institution, if established, could be associated with any testing or standardizing work already performed wholly or partly at the public cost." The committee was constituted as follows: Lord Rayleigh (chairman), Sir Courtenay Boyle, Sir Andrew Noble, Sir John Wolfe Barry, W. C. Roberts-Austen, Robert Chalmers, Prof. A. W. Rucker, Alexander Siemens and Prof. T. E. Thorpe. It will be seen that the majority of these gentlemen are Fellows of the Royal Society, and also that the engineering industries are represented on the committee as well as pure science. The report of the committee has just been issued. A number of witnesses were examined, a large proportion of whom were nominated by scientific and technical institutions. The committee visited the Physikalisch-technische Reichsanstalt, the Königliche Mechanisch-technische Versuchsanstalt and the Königliche Magnetische Institut in Germany, the work of which institutions is similar to that indicated in the above reference to the committee. The only English public institutions whose objects are at all similar to those required are the Standards Department of the Board of Trade and the Kew Observatory. The Standards Department of the Board of Trade was established to carry out the provisions of the Weights, Measures and Coinage act, and its chief duty is to preserve and restore, if required, standards of the various weights and measures. An important branch of this department is the Electrical Standards Laboratory, which was established in 1889. This branch has also done useful work in verifying electrical instruments for the measurement of current pressure, power, resistance, etc., but it does not certify meters for use in connection with electric supply. The Kew Observatory is a self-supporting institution, but owing to its restricted means the work done there is very limited. Besides being a meteorological station, a number of instruments, including watches, thermometers, sextants, barometers, etc., are verified, and it may be mentioned incidentally that the beneficial effect it has carried upon the watchmaking industry has been very noticeable. The committee now proposes that the Kew Observatory should be extended by adding new buildings at some distance from the present observatory. It proposes that the new institution should undertake work similar to that mentioned in the instructions to the committee, and that the Royal Society should be invited to control the proposed institution and nominate a governing body on which commercial interests would also be represented, the choice of members of this body not being confined to members of the Royal Society. The committee also proposes that the permanent secretary of the Board of Trade should be an ex officio member of the governing body. It is to be hoped that the Treasury will see that the recommendations of the committee are carried out in an adequate manner.

FRENCH NOTES.

(From Our Special Correspondent.)

PARIS, September 20, 1898.

THE ELECTRICAL BUILDING.—The operation of the great steam engines which will be exhibited in 1900 will require a pumping capacity which is estimated at 12,000 horse-power, equivalent to a delivery of water of about 264 gallons per second. It is a question whether this water, which will be brought from the Seine by means of a large pumping station, ought to be allowed to remain out of sight in the underground pipes, or ought not rather to be utilized before being passed to the machinery in furnishing sparkling fountains for the delight of the eye. It is the latter course which has been decided upon, and by the united efforts of M. Henard and M. Paulin, who have special charge of the water works, this building has been erected, where light and water have been so combined as to produce the most fairy-like effects. The fountain will be 34 metres high. The whole effect, I think, will be sufficiently attractive to draw to the Champs de Mars the visitors who would otherwise be detained at the Champs Elyseés and the Trocadéro by so many other objects of interest.

THE EXPOSITION OF 1900.—The general committee of the Universal Exposition of 1900 has just drawn up the agreement regulating the cost and conditions of transportation of the exhibits to be sent or which have already been sent to the exposition. This agreement was drawn up by M. Alfred Picard, administrator of the government railroads, represented by M. Metzger, the director, and the directors of the six great companies, Messrs. Heurteau, Blagé, Noblemaire, Barabaut, Sartiaux and Marin. The document consists of four articles, of which the following is a brief résumé: The three first articles treat of the cost and conditions of the transportation of objects of art, of valuables, animals, etc. Carriages and rolling stock of the French railways and intended for exhibition at the exposition will be transported to Paris at a reduction of 25 per cent. on the general tariff and on the special tariff applicable to the particular exhibit, and will be sent back at a reduction of 75 per cent. Article 3 treats particularly of the transportation of solid masses of 10 or 20 tons and of objects whose dimensions are excessive in proportions to their weight. Article 4 indicates the general conditions applicable to all exhibits sent, and specifies that these special rates will be granted only to such articles as are actually admitted to the exposition; all invoices will be addressed to the exhibitor on the grounds, and will be received by him or by an agent authorized by him to give a receipt on delivery. For the return of the exhibits after the close of the exposition these arrangements will hold good for only six months, at the outside, after the day on which the exposition is pronounced closed.

TRACTION IN PARIS.—There are in Paris at present nine different methods of mechanical traction, as follows: 1, the self-propelling steam car on the Rowan system; 2, hot water storage on the Francq system; 3, cable traction; 4, the steam motor car on the Serpollet system; 5, the slow-charging accumulator; 6, compressed air; 7, electric traction by surface contact; 8, the quick-charging accumulator; 9, Serpollet's improved system. The Paris General Tramway Company has just installed mechanical traction on the Bastille-Charenton line. The General Omnibus Company has petitioned for the franchise necessary to establish mechanical traction on sixteen of its tramway lines. The expense necessary for the completion of the change over of the tramway lines is estimated at 90,000,000 francs. The latest plan of the Metropolitan calls

for 220,000,000, thus making up a total of 310,000,000 for the improvement of the transportation facilities of Paris. My hope is that these millions may be expended before the exposition of 1900, so that the visitors from other countries may not be able to reproach the capital of the world for maintaining the worst service of all the capitals of the two hemispheres. The Omnibus Company is displaying the utmost parsimony and delay in its submission to the orders of the Government. Although it was required eighteen months ago to substitute electric for horse traction on its tramway lines, it has carefully selected the worst systems with which to make experiments. Just at present an investigation is going on with regard to the form of traction of the line extending from the Gare de l'Est to Montrouge. Those who have charge of the affair should require not only electric traction, which is the only form practicable for Paris, but also a reduction of fares. The Omnibus Company will make the enormous saving of 75 per cent., and the public ought to profit by it.

THE MUNICIPAL INSTITUTE OF ELECTROTHERAPEUTICS AT LA SALPETRIERE.—This is the name which is given to the independent service of electrotherapeutics at La Salpetrière since its recent installation in that portion of the institution which is especially devoted to it. An enormous isolated pavilion has been erected for the exclusive use of the electrotherapeutic service. This pavilion fronts directly on the Boulevard de l'Hôpital. On entering, the eye is caught at once by two large therapeutic tables. Let us call attention here to the fact that the electrotherapeutic table which was originated by Brenner (1868) was used in France for the first time at La Salpetrière. The model arranged by Dr. Vigouroux was, at the time, made the subject of detailed articles in the publications of the day. Next to these electrotherapeutic tables are placed the apparatus intended for the applications of static electricity, another branch of electrotherapeutics which is also being restored by the service at La Salpetrière. The static electricity apparatus fills nearly two-thirds of the hall. Most noticeable are two large Wimshurst machines, furnished each with two pairs of plates 1 metre in diameter. Each machine is placed at the head of a row of insulating platforms on which are eight stools, an arrangement which admits of electrifying sixteen patients at once. Here we may call attention to the fact that it was at La Salpetrière that the Wimshurst machine was first introduced into France and received the well-known shape used for medical purposes. Special precautions, arranged by the aid of some entirely new devices, neutralize the effect of the weather changes, which have always given so much bother heretofore, and assure a perfecly reliable operation of the electricity. Two extra machines of smaller dimensions than the principal one are kept in reserve and close at hand in case of accidents. The motive power is furnished by the district on the left bank. But as the company uses alternating current, it must for reasons easily understood be transferred. The Brown transformer is in the same hall. The plant was planned with a view to permit the use at will of either kind of current. The direct current is used for the motor which drives the electrical machines. A gramme laboratory machine and a powerful Ruhmkorff coil and a few other accessories complete, or rather will complete, this collection, for the Ruhmkorff coil is still to be set up.

General News.

THE TELEGRAPH AND TELEPHONE.

MOUNDSVILLE, W. VA.—The Panhandle Telephone Company has been organized here with an authorized capital of $50,000.

CHICAGO, ILL.—Corporation Counsel Thornton holds that the slot machine telephone as used by the Chicago Telephone Company is illegal.

PEORIA, ILL.—The Central Union Telephone Company is to at once practically rebuild its plant in Peoria, at a cost of $75,000 to $100,000, laying 82,000 feet of underground wiring.

MEDINA, OHIO.—The Medina Telephone Company, of Medina, has been organized with a capital stock of $20,000. Incorporators: Samuel B. Rawson, T. M. Brush, A. E. Lord and others.

BLOOMINGTON, ILL.—The Kankakee County Telephone Company will soon incorporate. F. G. Snow, recent manager of the Eastern Illinois Telephone Company, is the principal promoter.

URBANA, OHIO.—The Urbana Telephone Company has been incorporated with a capital stock of $30,000. The company will operate a telephone system in Urbana and between Urbana and Bellefontaine, Marysville, London, Troy, Sidney and Springfield. D. B. McDonald, E. L. Barber and J. S. Bailey are among the incorporators.

ANDERSON, IND.—The New Telephone Company, of Indianapolis, has been granted a franchise by the City Council. The company made a contract with the Overshimer Company, of Elwood, an independent organization, by which all patrons of the latter may use the New Company's toll lines. The New Company expects to have its exchange in operation in this city before January 1.

RALEIGH, N. C.—The Thomasville Telephone Company has been incorporated with a capital stock of $6000. F. S. Lambeth, J. W. Lambeth, C. A. Julian, J. F. Haden, W. E. Evans, R. W. Thomas, C. R. Thomas, W. M. Morton, A. Johnson, J. B. Boone and J. A. Green are the incorporators. The company purposes to erect a telephone system in the town of Thomasville and the surrounding county.

NORWALK, CONN.—Mr. James B. Morris, manager of the Norwalk branch of the Southern New England Telephone Company, secured a permit from the Norwalk City Council to extend the company's underground conduits from the city line to the Norwalk Hotel. The work will be commenced at once, and will probably be completed by December 1. The conduits are cement lined, each carrying one cable containing between 100 and 200 wires.

HARRISBURG, PA.—A charter has been issued to the Cumberland Valley Telephone & Telegraph Company, of Chambersburg, to erect and maintain lines in Franklin and Cumberland counties. The directors are D. K. Appenzellar, J. O. Skinner, Isaac Lesher, D. L. Grove, W. L. Minnich, E. M. Smith, H. B. McNulty, of Chambersburg; John A. Zollinger, of Orrstown, and A. C. Gelwicks, of St. Thomas. The capital of the company is $50,000.

BAY CITY, MICH.—The Valley Telephone Company has filed a mortgage to Thomas Cranage, trustee, and covering an issue of bonds to the amount of $70,000, the proceeds of the bonds to be used in the work of completing the plant. The bonds will bear date September 1, 1898, and are to be paid in annual installments of $10,000, beginning September 1, 1901, with interest at 5 per cent. per annum. The telephone company is to continue to manage and operate the system in the valley until default is made in the payment of principal or interest of the bonds, the default to continue for ninety days.

HARTFORD, CONN.—The Southern New England Telephone Company has about completed the laying of a cable connecting Gull Island, where the Government fortifications are being built, with Goshen Point on the Connecticut shore. The work was undertaken a month ago, and the cable was laid under the supervision of General Superintendent E. B. Baker. It is 5 miles long. The Government in completing the Race fortifications has established communications with Washington or anywhere else by means of the cable just laid. It can be used either for telegraphic or telephonic purposes.

DENISON, TEX.—The Conway Telephone Company is now building a line from Tishomingo to Denison. The line is constructed as far as Emet, and will come down the Washita River from there to Linn, from Linn to Cumberland, Cliff, Grantham and small towns in that section, then across country to Mead and to Colbert and from Colbert to Denison. This is the same line that now runs from Tishomingo to Oakland and from Oakland to Ardmore. It will connect every town in the Chickasaw nation by telephone in the near future, and it is expected that it will be in operation into Denison by the middle of December or perhaps before that time.

GRAND RAPIDS, MICH.—The long delayed fight between the Bell and Citizens' telephone companies came to a head a few days ago when the agents of the American, Adams, United States and National express companies ordered the Citizens' 'phones out of their offices and refused to allow their employees to answer them when they rang. The Citizens' Company was asked to furnish the 'phones free of charge, and refused, and this is the result. The Bell Company is opening a bitter fight against the local concern, and it is expected to push the boycott movement into the railroad and telegraph offices. The Citizens' Company promptly hired a store near the express offices, put in 'phones and messenger service and gives patrons service to the express companies in that way.

NEW YORK, N. Y.—According to the annual report of the Western Union Telegraph Company for the year ended June 30 the number of miles of poles and cables operated by the company at that time was 189,847; miles of wire, 874,420; number of offices, 22,210. The number of messages handled during the year was 62,173,749, the average tolls per message being 30.1 cents. The average cost of a message was 24.7 cents. President Eckert explains in his report that the decrease of 767 miles of poles as compared with the previous year was caused by the abandonment of certain highway lines, which it would otherwise have been necessary to reconstruct at a large cost, and the transfer of the wires therefrom to newer poles on parallel railroad routes. The decrease in the average tolls received and the increase in the average cost per message are accounted for by the large number of Government and press messages consequent upon the war with Spain, transmitted during the latter part of the fiscal year, on both of which classes of messages the tolls are the lowest. The cost of construction of new property for the year was $1,117,651.

ELECTRIC LIGHT AND POWER.

BUSHNELL, ILL.—The Lewistown Electric Light Company has disposed of its stock for $5000 to a new company.

LEBANON, PA.—The Council will secure estimates on a municipal lighting plant. The present contract for electric lighting expires in June, 1899. George W. Hayes is city engineer.

MARSHALL, WIS.—The Marshall Electric Lighting & Power Company, with a capital stock of $2000, has been organized. Mr. W. H. Porter is president, A. D. Kelley secretary and treasurer.

AKRON, N. Y.—The village of Akron is contemplating a municipal electric lighting plant. The estimated cost of a plant with thirty arc and 600 incandescent lamps is $3000. At present the village is lighted by kerosene.

COXSACKIE, N. Y.—The new electric light plant in this place was put into practical operation recently. It contains one 80-arc light dynamo, one incandescent alternator of 1500-light capacity, both made by the Fort Wayne Electric Corporation.

PHILADELPHIA, PA.—The Cheltenham Electric Light, Heat & Power Company, Oak Lane, Philadelphia, is in the market for arc light machinery and appliances for about eighty lights. Mr. George U. G. Holman, manager of the company, can give further information.

WABASH, IND.—The Common Council of Columbia City has purchased the electric plant owned by a commercial corporation in that town for $21,000. The property is to be paid for in ten annual installments, and the city will not only operate the plant for street lighting, but will furnish domestic service.

PATCHOGUE, L. I., N. Y.—The Patchogue Electric Light Company will probably extend its lines to Blue Point, Bayport and Sayville. If the proposition goes through the company will erect a new brick power house on its lot adjoining the Patchogue River and install a new 1000-hp dynamo and add other improvements. It is expected to have the extension completed by December 1.

WILKESBARRE, PA.—A syndicate of local capitalists has secured an option upon and agreed to purchase a majority of the capital stock of the Wilkesbarre Electric Light Company at a price said to be $200 per share. Parties owning about three-fourths of the stock have already signed an agreement to sell their holdings at the price mentioned. It is understood that Abram Nesbitt will be president of the company under the new management.

NEW YORK, N. Y.—The firemen and oilers at the power house of the New York & Staten Island Electric Company, at Livingston, S. I., are out on a strike. Some wires have been cut, leaving the streets in sections of the island in darkness for the time being. Men were sent out at once to make repairs. The electric lighting service, however, is somewhat crippled, although some of it has been restored.

The Electric Railway.

TRENTON, N. J.—The trolley line between Trenton and Bordentown is now complete.

NYACK, N. Y.—It is probable that active work of construction on the Nyack trolley road will begin on or about October 20, and it will then proceed until the road is completed and in running order.

BOULDER, COL.—Boulder is to have an electric street railway. The City Council has granted a franchise to a company on condition that it get the consent of half the property owners whose property fronts on the proposed line, and also enter into bonds to complete and operate the road to the Chautauqua grounds by June next.

DETROIT, MICH.—The long-standing dispute over the granting of a franchise for a railway through Highland Park village was terminated when the Village Council, by a unanimous vote, granted a thirty-year franchise to the Citizens' Railway Company, of Detroit, to extend its tracks north from the Highland Park Hotel to the village limits at the Six-Mile road, a distance of half a mile.

WASHINGTON, D. C.—Consul Liefeld at Freiburg, Germany, writes to the State Department that a good deal of work is at present being done in that country in the line of electric railways. In a recent Berlin paper the claim was made that there were 707 miles of electric road in Germany to 715 miles in all the rest of Europe, and that in Germany there were 2492 electric cars, against 2021 in all the other countries of Europe.

NEWBURYPORT, MASS.—The Citizens Electric Street Railway Company has been organized to build and operate an electric railway in this city and between this city and Amesbury. The line will be 14 miles in length. The capital stock of the company is $150,000. Directors, Charles Goss, Amesbury, Mass.; James F. Shaw, H. I. Bartlett, F. L. Atkinson and A. C. Titcomb, Newburyport, Mass.; A. D. Bosson, Chelsea, Mass., and W. B. Ferguson, Malden, Mass.

OAKLAND, CAL.—By the bursting of three large cast-iron fly-wheel pulleys in the power station of the Piedmont electric road at Twenty-fourth Street and Oakland Avenue, in this city, a portion of the plant was destroyed. Large pieces of iron were hurled in all directions. One of the pulleys was 9 feet in diameter and the others 7 feet. The shaft was making 250 r. p. m. at the time of the accident, and the heavy steel shaft was twisted off. The damage to the station amounted to about $2000.

MOLINE, ILL.—A deal of considerable magnitude and of great importance to Moline, Davenport and Rock Island has been made public. It is the purchase by local capitalists of a controlling interest—something over $300,000—in the stock of the Tri-City Railroad Company from the Chicago men who organized and capitalized it. The company owns and operates a complete system of 41 miles of electric lines in the three cities, including a line across the Mississippi River. The capital stock is $400,000, with bonds which increase the total to about $1,000,000.

ROCKVILLE, CONN.—The recent report of the Hartford, Manchester & Rockville Tramway Company shows the successful operation of one of the long-distance electric railways of the State. The line from Hartford to Rockville is about 17 miles long. When it was opened, nine months ago, the opinion was ventured by railroad men and capitalists that it would never pay. Through the efforts of Mr. M. S. Chapman, the president, who had entire confidence in the enterprise, the reverse results are recorded, and the company, it is stated, has earned a net income of $12,688. The passenger receipts were $57,015, the operating expenses $38,778.

WHITMAN, MASS.—The Whitman selectmen have granted a franchise to the Brockton & Whitman Street Railway Company. The Bridgewater, Whitman & Rockland Company will probably run through cars from Rockland to Brockton, competing with the Rockland & Abington Company. The new company intends to construct a line to Brockton from that part of Whitman known as Auburnville. In order to make quick time through the woods, the company has secured land over which to run the road, and thus will be allowed to construct in such a manner as to allow the limit of speed. The road is to be ballasted the same as a steam road, the rails are to be of the most approved pattern and will weigh 80 pounds to the yard. They will be 60 feet long. The construction is to be similar to the line between Providence and Taunton.

Legal Note.

MORRIN CLIMAX BOILER PATENTS SUSTAINED.—In the United States Circuit Court for the Eastern District of New York Judge Thomas has rendered a decision in the patent infringement suit of Thomas F. Morrin v. Thomas J. Lawler and Thomas F. Morrin and the Clonbrock Steam Boiler Company v. the Edison Electric Illuminating Company of Brooklyn, favoring the complainants, the Clonbrock Steam Boiler Company, and sustaining the validity of the patents under which are manufactured the Morrin Climax boiler. The history of the case, as set forth in the judge's opinion, is in brief as follows: Mr. Lawler was a director, vice-president and general manager of the Clonbrock Steam Boiler Company until the early part of the year 1896, when he, under the name of the Columbian Steam Boiler Works, undertook the manufacture of boilers in all essential particulars duplications of the Climax boiler. A boiler manufactured by Mr. Lawler was completed for and accepted by the Edison Electric Illuminating Company, of Brooklyn. Suit to prove infringement of the Morrin patents was brought by the Clonbrock Company, with the result as already stated. The opinion of Judge Thomas is a sweeping argument in favor of Morrin's patents as novel, useful and valuable and a declaration that they were infringed by the defendants.

Personal Notes.

MR. GEORGE A. RICKER, chief engineer of the Buffalo Traction, Gorge & Buffalo Valley trolley lines, is in Colorado acting as consulting engineer of some extensive irrigation enterprises there.

MR. MAXWELL S. COOLEY, of Dannemora, N. Y., was married on October 17 to Miss Grace C. Bogart, of Elmira. Mr. Cooley is the electrician of Clinton Prison, and is a graduate of Cornell. His many friends wish him a long, happy and prosperous life.

DR. CARY T. HUTCHINSON has been chosen to fill temporarily the position of director of the course of electrical engineering at Johns Hopkins University in Baltimore. This position was held by Dr. Louis Duncan, who has been granted sick leave for a year.

Educational Notes.

ELECTRICAL ENGINEERING COURSES BY MAIL.—The electrical courses of the United Correspondence Schools, 156 Fifth Avenue, New York City, it is stated, continue to give satisfaction. The scope of these courses is such as to practically cover the electrical field and furnish a course which will suit the requirements of anyone desiring to perfect himself either in some particular branch of electrical engineering or to increase his general information. The courses include complete electrical engineering, complete station engineering, electrical station engineering, electric lighting, electric railway, telegraph, telephone and electroplating courses. Mechanical drawing and the design of dynamos and motors are also taught in connection with the above-named courses, the tuition fees for which are so low as to be within the reach of all. These fees include the cost of specially prepared text books, examinations and drawing plates. The schools will send a copy of their circular free to any one interested in any one of the subjects taught.

THE AMERICAN SCHOOL OF CORRESPONDENCE, of Boston, has, it is stated, been most successful in imparting to engineers and mechanics a thorough knowledge of the theory and practice of their profession by means of its thoroughly up-to-date system of instruction by correspondence. Its courses are limited strictly to steam, electrical and mechanical engineering, and, as these courses have been prepared by well-known educators and experts they are complete, accurate and thoroughly abreast of the times. The success and popularity of this institution in fitting students for better positions is the direct result of the school's policy of concentration of energy, specialized courses and thorough instruction under expert supervision. The school is chartered by the Commonwealth of Massachusetts, and, as its chief aim is to benefit the ambitious workman, the tuition is placed very low in order that every mechanic may secure the technical knowledge necessary for advancement in his profession. The school will send a handbook to any address on request.

THE ELECTRICAL ENGINEER INSTITUTE OF CORRESPONDENCE INSTRUCTION.—The managers of this institution are energentically reaching out after pupils. Three of its representatives recently attended a meeting in Newark of exchange managers, switchboard men, linemen, etc., of the New York & New Jersey Telephone Company, from many of the New Jersey cities in this vicinity, at which the plans, purposes and methods of the institute were set torth. It is stated that at the close of the meeting a large number of enrollments of students, chiefly for the special course in telephony, was entered. A series of technical lectures by eminent electricians is in contemplation to be given during the coming winter in Brooklyn, Jersey City and Newark, to harmonize with or make additionally beneficial the institute's results. It is stated that the work of the institute is much appreciated by the officers of the New York & New Jersey Telephone Company, and that this encouragement led the institute management to decide upon giving the lectures as above noted.

Trade and Industrial Notes.

THE METROPOLITAN ELECTRICAL SUPPLY COMPANY, Chicago, Ill., has been formed with a capital stock of $15,000. The incorporators are William E. McKinlock and George Dickinson.

MESSRS. A. C. POWELL & SON, one of the well-known machinery houses of Syracuse, N. Y., will soon add to its business a full line of direct current dynamos and motors, both for direct and belt connection.

THE OHIO BRASS COMPANY, Mansfield, Ohio, has opened a branch office in New York at 39 Cortlandt Street. Mr. R. A. Byrns, formerly of the Walker Company, is in charge and will represent in this section the well-known specialties manufactured by the Ohio Brass Company.

THE GENERAL Eastern office of the Siemens & Halske Electric Company, of America, has been removed to the Land Title Building, Philadelphia, Pa. The company's New York office for local business (Metropolitan district) is now located at Room 511, Cable Building, 621 Broadway, New York City.

MESSRS. HUEBEL & MANGER, 286 Graham Street, Brooklyn, N. Y., have just issued their catalogue No. 4, containing full descriptions, illustrations and prices of their new electric bells, gongs, push buttons and other electrical fittings for household use. A copy of this catalogue will be sent to anyone interested upon writing to the firm.

MR. HENRY EAGER has resigned his position as superintendent of the Onondaga Dynamo Company, Syracuse, N. Y., and associated himself with Messrs. A. C. Powell & Son, of the same city. Mr. Eager was connected with the Onondaga Dynamo Company since the organization of that concern. Messrs. A. C. Powell & Son will hereafter manufacture dynamos and motors.

THE AULTMAN COMPANY, Canton, Ohio, describes and illustrates in a recently issued catalogue (C) its various manufactures in the line of elevating and conveying machinery, power transmission and labor-saving appliances. A very complete set of price lists of the various classes of products is given. The catalogue has 136 pages, and bears evidence of careful design and preparation.

MESSRS. H. H. PRATT AND J. P. MULLANY, of Buffalo, N. Y., have entered the steam, water and electrical construction business under the name of

the Central Construction Company, and have taken offices in 263 Main Street, Buffalo. This company is prepared to do all kinds of mechanical and electrical construction work, including the installation of engines and boilers and complete electric plants.

"DEPRECIATION OF CANDLE POWER OF WELSBACH MANTLES" is the title of a small pamphlet just issued by the General Electric Company. It gives the result of interesting tests made both in mantles and electric incandescent lamps, and contains information of use to every electric light station manager, as well as to the general public. A copy of it will on application be sent by the General Electric Company to anyone interested.

THE BROWN & SHARPE MANUFACTURING COMPANY, Providence, R. I., recently installed a Rice & Sargent compound condensing engine of 350 indicated horse-power in the main machine shop. The new engine displaces a pair of non-condensing simple engines of the Corliss type, and it is stated that the change will effect a saving of 10 tons of coal a week. The gain in economy illustrates the great advance made in steam engineering during the past twenty years.

THE WHITING FOUNDRY EQUIPMENT COMPANY, Harvey, Ill., has just issued its new general catalogue descriptive of its electric traveling cranes and hoists suitable for central stations and electrical repair shop work, together with its labor-saving devices of interest to the electrical industries generally. The catalogue is gotten up in a most attractive and instructive manner, and should be on file in the office of every one interested in this class of apparatus.

"PEGAMOID" aluminum paint is recommended by the American Pegamoid Company, 346 Broadway, New York, for qualities which are valuable in the electrical industries. It dries quickly and is untarnishable, washable, water, oil, grease and weather proof. It is stated to be excellent for protecting and decorating dynamos, motors, arc lamps, sockets, brackets and all kinds of metal work. It possesses the important property of being very adhesive to the article to which it is applied, and electrical manufacturers will do well to look into its merits.

OF THE MANY ELECTRICAL SIGNS erected for the Knights Templar conclave, which was held in Pittsburg last week, some of the most elaborate were built complete by Doubleday, Hill & Co., of Pittsburg, and for many others the same firm supplied the material. Among the former was a large sign 36 feet in length erected for Weyman & Co., consisting of two waving flags and a handsome centre piece. This required 1200 8-cp lamps. In the window of the headquarters of Doubleday, Hill & Co. there was also a handsome shrine emblem, consisting of a sword, crescent and Maltese cross.

A 30-TON ELECTRIC CRANE, having a span of 46 feet, will be installed in the extension of the foundry of the Benjamin Atha & Illingsworth Company at Harrison, N. J. The Berlin Iron Bridge Company, East Berlin, Conn., is erecting this extension, which will be 51 feet wide and 152 feet long, the framework being of steel throughout. The sides are covered with corrugated iron on steel purlins, and are arranged for suitable doors and windows. The electric crane will be supported on the side columns. The roof construction is of steel trusses and purlins arranged with openings in the roof for skylights.

CONDUIT INSTALLATION.—A contract has been awarded by the Narragansett Electric Lighting Company, Providence, R. I., to the Standard Fireproofing Company, New York, for the conduit for the installation of an underground system in the city of Providence. The Potomac Terra Cotta Company, Washington, D. C., has furnished about 100,000 feet of the conduit. This, it is stated, is the first terra cotta conduit to be laid in New England, and as this particular make of conduit has given much satisfaction in other sections it will probably lead to other big shipments to New England territory in the near future.

THE ELECTRICAL TRADES SOCIETIES of the different cities met in convention at the Burnet House, Cincinnati, October 7, and formed a national credit association, adopting a constitution and by-laws governing its business policy. The board of managers consists of one member from each local society, and it is the purpose of the national society to issue monthly lists of delinquents and furnish such other information as may be of interest to its members. As the association grows stronger it is purposed to establish a credit bureau by which it hopes to be able to keep members thoroughly informed regarding buyers of electrical goods.

THE CABINET MANUFACTURING & SUPPLY COMPANY, 244 The Arcade, Cleveland, Ohio, has succeeded to the business of the Cabinet Manufacturing Company, of Steubenville, Ohio. The company is prepared to furnish telephone woodwork and various kinds of cabinets of first-class workmanship at reasonable prices. Mr. M. T. James, a well-known business man who was the originator of the Cabinet Manufacturing Company, is secretary and treasurer of the Cabinet Manufacturing & Supply Company. The quality of the work turned out by the company is thus guaranteed. Manufacturers of telephones and others interested will find Mr. James in every way worthy of their confidence.

THE VICTOR TELEPHONE MANUFACTURING COMPANY, Chicago, is enjoying a very active business. Among its recent shipments was an exchange equipment of a capacity of 200 'phones to Mitchell, S. Dak. This included switchboard, telephones, cross-connecting boards, lightning arresters, etc. The company is engaged just now, besides other work, in filling an order for an exchange equipment for Paxton, Ill. This exchange will have a 200-'phone capacity. A switchboard of 400-drop capacity for Champlain, Ill., and a complete outfit of 100 capacity, including all central station apparatus and 'phones, for Rantoul, Ill., are also going through the Victor Company's factory. In addition to the above the company is engaged on a large amount of other telephone work for early delivery.

THE MASON VITRIFIED SALT-GLAZED TERRA COTTA CONDUIT made by the Potomac Terra Cotta Company, Washington, D. C., does not absorb water and is indestructible by the elements when properly laid. These conduits are salt-glazed inside, as well as out, and offer little or no resistance by friction in drawing in cables. The standard length is 30 inches, and they are made in two and four-way patterns, with ducts of 3 inches and 3¼ inches in diameter, suitable to carry the largest sized cables. Iron dowels secure perfect registration of the ducts and prevent displacement. The Mason ducts are extensively used in Washington by the Postal Telegraph Company, the Chesapeake & Potomac Telephone Company, the United States Electric Light Company and the Potomac Electric Power Company.

WATER WHEEL GOVERNORS.—The Lombard Water Wheel Governor Company, Boston, Mass., has just issued a catalogue in which is given a general description of the water wheel governors manufactured by it, together with a few speed diagrams, showing the degree of regulation which they have produced under various conditions in actual practice. It also contains copies of a few letters from those who are using the company's governors, setting forth their experience with and opinion of them. These governors are so designed that they fully compensate for the momentum and inertia effects in the moving water column, and the fly wheel effects in the rotative parts, so that they prevent the water wheels to which they are attached from racing. They are dead beat and move the water wheel gates by one prompt motion to the correct position for every change of load. The various types of governors are well illustrated, as are also several prominent installations. The catalogue embraces in condensed form such data taken from actual practice as will be of most value to those interested in the speed regulation of water wheels and steam engines. The Lombard Company makes governors for steam engines as well.

THE HARRISON SAFETY BOILER WORKS, Philadelphia, Pa., reports a long list of recent sales of Cochrane feed water heaters and purifiers, including the following: Schoenberger Steel Company, Pittsburg, Pa., two 2500 horse-power; Sheffield Electric Company, Sheffield, Ill., one 100 horse-power; the Lane & Bodley Company, Cincinnati, Ohio, two 200 horse-power and one 300 horse-power; Clinton Cement Company, Pittsburg, Pa., one 300 horse-power; Pennsylvania Manufacturing Light & Power Company, Philadelphia, one 2000 horse-power; Washington Coal & Coke Company, Star Junction, Pa., one 500 horse-power; Pennsylvania Railroad Company, Broad Street Station plant, Philadelphia, one 2000 horse-power special; Charles Erith & Co., London, England, one 100 horse-power. The following is a partial list of recent sales of Cochrane separators made by the same company: Philadelphia (Pa.) Engineering Works, one 8-inch, two 6-inch and one 3½-inch horizontal; De la Vergne Refrigerating Machine Company, New York City, one 6-inch oil ammonia separator; F. R. Dravo & Co., Pittsburg, Pa., one 4½-inch horizontal; Massachusetts Institute of Technology, Boston, Mass., 8-inch horizontal; United Gas Improvement Company, Philadelphia, Pa., one 6-inch, one 8-inch and three 5-inch horizontals; Arizona Copper Company, Ltd., Clifton, Ariz., one 5-inch horizontal; Spring Garden Institute, Philadelphia, one 7-inch horizontal; Fraser & Chalmers, Chicago, one 6-inch horizontal and one 8-inch vertical; Charles Erith & Co., London, England, one 6-inch horizontal; Cleveland (Ohio) Rolling Mill Company, six 8-inch, one 5-inch and one 4-inch vertical; East Jersey Water Works, Little Falls, N. J., two 8-inch vertical; Denver Engineering Works, Denver, Col., one 3½-inch and two 4½-inch horizontal; Cambria Iron Company, Johnstown, Pa., two 16-inch horizontal and one 6-inch horizontal; Oliver-Snyder Steel Company, Edith Furnace, Allegheny County, Pa., one 6-inch horizontal; Jordan, Marsh & Co., Boston, Mass., 5-inch vertical; Gloucester (Mass.) Water Works, 5-inch horizontal; Filer & Stowell Company, Milwaukee, Wis., one 10-inch horizontal; Brooklyn, N. Y., Post Office, one 6-inch vertical and one 6-inch horizontal.

Business Notices.

THE ILLUSTRATIONS in this issue were made by the Photo-Engraving Company, 9-15 Murray Street, New York City.

THE WAR IS OVER, and now our thoughts are all of peace and home. There are, too often, people to be found who have no home, and it is to them these few words are addressed. If you really want a home you can easily get one, but you should act at once before the relapse from the war puts prices on the advance. In Marinette County, Wisconsin, the very finest farming land is to be had now at a most modest figure. Excellent home markets are at hand to take whatever the farmer raises, and good prices are given. These lands are on the Chicago, Milwaukee & St. Paul Railway, and full information concerning them will cheerfully be furnished by C. E. Rollins, Immigration Agent, 161 La Salle Street, Chicago.

UNITED STATES PATENTS ISSUED OCTOBER 11, 1898.

[In charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

11,697. CONDUIT OUTLET INSULATOR; F. W. Erickson, of Boston, Mass. App. filed June 25, 1898. An outlet insulator for conduits comprising a hollow metallic member having one end of its inner surface screw threaded and the other end enveloped or lined with insulating material.

612,015. LIGHTNING ARRESTER; C. C. Chesney, of Pittsfield, Mass. App. filed Jan. 15, 1898. In a system of distribution, the combination of a lightning arrester and a coil having portions reversely wound in close proximity to each other, said coil being placed between the lightning arrester and the apparatus to be protected.

612,038. ELECTRIC SWITCH; G. W. Hart, of Hartford, Conn. App. filed

Oct. 23, 1896. An electric switch, consisting of a base of insulating material, contacts mounted thereon, an operating mechanism having a switch plate in operative relation to said contacts, said base being cup-shaped and having in its outer walls open grooves leading from the bottom of said base to said contacts, substantially as described.

612,062. TROLLEY ARM; B. R. Shopp, Jr., of Jersey City, N. J. App. filed March 15, 1894. The combination, with a trolley arm and an elongated roller pivoted therein as a trolley wheel, of guides located at opposite sides of the trolley arm, the said guides having inclined surfaces leading upward and inward to the peripheral surface of the roller at its ends, the said guides being arranged in longitudinal alignment with the said roller and with each other, as and for the purpose specified.

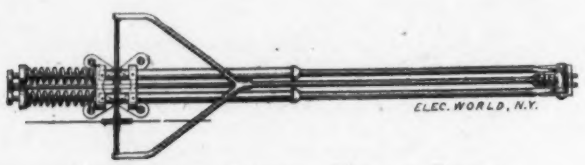
612,068. ELECTRIC RAILWAY; F. D. Sweet, of Elyria, Ohio. App. filed Nov. 22, 1897. In an electric railway, a bar suspended from the under side of the truck and through which the electric current is made to pass, a series of loosely pivoted strips pivoted at their upper ends upon the bar and which are free to swing back and forth thereon, and means located below the pivots for limiting the amount of movement which the strips shall have, combined with boxes arranged along the track and with which the strips make connection as they pass over them.

612,122. ELECTRICAL CONVERTER; F. Schwedtmann, of St. Louis, Mo. App. filed Aug. 28, 1897. In a converter, a suitable casing, a main chamber in said casing, a core in said chamber, supporting frames holding said core by means of projections engaging with the edges thereof, and side chambers into which the coils of said core project through openings in said supporting frames.

612,123. ELECTRICAL CONNECTOR; F. Schwedtmann, of St. Louis, Mo. App. filed Nov. 11, 1897. An electrical connector, consisting of an inner and an outer member, having smooth contact surfaces, one of said members being tubular and slit along a portion of its length to form a plurality of tongues or strips and an annular spring for forcing said tongues or strips against the other member, said annular spring having its axis coincident with the axis of said tubular member.

612,132. ELECTRIC TROLLEY DEVICE; C. L. Jeffrey, of Johnstown, Pa. App. filed Jan. 12, 1898. In an electric trolley device, normally free to move in a vertical plane, a lock for preventing said movement, said lock being actuated by the lateral movement of the trolley device when the same is in a predetermined vertical position.

612,139. CASING FOR ELECTRIC CAR LIGHTING APPARATUS; W. F. Richards, of Buffalo, N. Y. App. filed Nov. 26, 1897. The combination with a car body, a car axle and the truck frame, of a dynamo supported by the car body and capable of moving toward and from said axle, driving mechanism for transmitting motion from said car to the dynamo, and a casing enclosing said driving mechanism, and composed of a front section mounted with its front portion on said axle, so as to vibrate vertically therewith, and hinged at its upper rear end to the truck frame, and a rear



No. 612,132.—ELECTRIC TROLLEY DEVICE.

section having a loose telescopic connection with the rear end of said front section, and mounted with its rear portion on the dynamo, substantially as described.

612,146. ELECTRIC SYSTEM OF DISTRIBUTION; J. P. Thomas, of Johnstown, Pa. App. filed Feb. 15, 1898. The combination with the disconnected contact sections of an electric railway of the subsidiary junction boxes, one beside each disconnected contact, feeders passing through said subsidiary junction boxes, and a short contact feeder connected thereto and leading from within the said box to the disconnected contact beside the same.

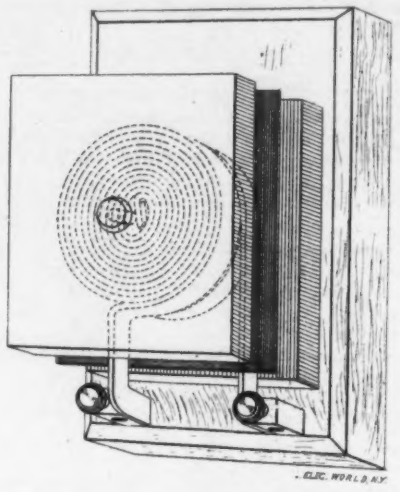
612,152. ELECTRIC LAMP SOCKET; F. M. Bell, of New York, N. Y. App. filed Jan. 10, 1898. A socket, comprising a casing, a base of insulating material arranged therein, a central contact and contact fingers arranged upon said base, and a spiral supported by said contact fingers, substantially as described.

612,192. HINGE CONDUCTOR FOR ELECTRIC CURRENTS; F. E. Chandler, of Brandon, Vt. App. filed Jan. 8, 1898. A hinge for doors, having a hollow pintle, in combination with an electric conductor of unbroken continuity, the ends of which are secured to opposite wings of the hinge, so as to bring the intermediate portions of the said conductor within the said hollow pintle.

612,203. CONTROLLING SWITCH FOR ELECTRIC MOTORS; R. Hutchison, of Mobile, Ala. App. filed Feb. 17, 1898. The combination of two electric motors, a motor circuit therefor, a multiple contact switch for connecting said motors in series and in parallel branch circuit with respect to each other, a locking device for said switch, and an electromagnet responsive to a predetermined strength of current having its coil located in said circuit in series with one motor and in parallel with the other, substantially as described.

612,212. RHEOSTAT; E. O. Raster, of Chicago, Ill. App. filed April 11, 1898. A rheostat or heater, comprising a frame adapted to receive a plurality of sets of resistances, each of which comprises a plurality of resistance sticks alternated with contact and insulating pieces, and means for clamping said sets of resistances in said frame, comprising devices mounted in one member, and adapted to bear against said sets of resistances and clamp same against another member of same frame, substantially as described.

612,219. TELEPHONE CENTRAL STATION APPARATUS; J. H. West, of Berlin, Germany. App. filed July 8, 1896. The combination of telephone lines, spring jacks therefor at several switchboards to which the lines are connected, an annunciator for each line and normally connected therein, a visual indicating signal for each line, one terminal of each indicating signal being normally connected to a source of electricity, the other terminal being connected to two circuit controlling devices, one controlled by the operation of the annunciator, the other forming a part of the spring jack, being controlled by insertion of a plug in said jack.



No. 612,015.—LIGHTNING ARRESTER.

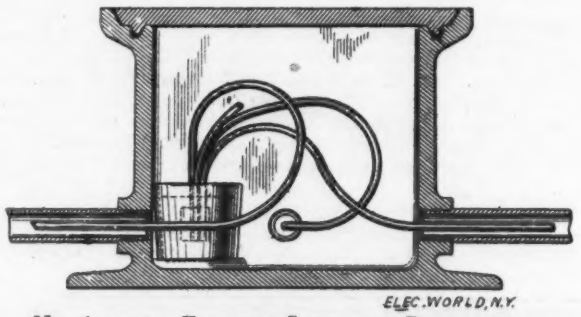
612,234. ELECTRIC TRACTION APPARATUS; R. Demeuse, of Brussels, Belgium. App. filed July 23, 1897. The combination with the electromagnets and their armature, of wedge blocks arranged on opposite sides of said armature, depending hinged and spring-pressed flaps to receive the wedge located on the upper side of the armature, and upwardly extending springs to embrace the wedge located on the under side of said armature.

612,255. TROLLEY POLE; V. A. Mason, of Austin, Tex. App. filed April 20, 1898. A trolley pole, comprising the butt section, the hollow wheel section hinged at one edge of its end to the butt section and the spring arranged within the hollow wheel section, secured at one end in connection with the wheel section and at its other end in connection with the butt section and operating by a contracting tension to tilt the wheel section on its pivotal connection with the butt section, substantially as described.

612,326. ELECTRIC BATTERY; M. E. Fuld, of Baltimore, Md. App. filed Aug. 4, 1897. The combination with the cells of an electric battery, of cell cases enclosing said cells, said cell cases being provided with recesses in their upper edges, caps enclosing the upper ends of said cell cases and extending into said recesses, enlarged supporting terminals screwed into said caps, a cell support and removable devices securing the said terminals to the said support, substantially as described.

612,344. UNGERGROUND ELECTRIC RAILWAY; C. W. Jenkins, of Richmond, Va. App. filed Oct. 28, 1897. A conduit for electric railways provided with transverse insulating beams for the insulators and the insulators supported by and arranged alongside the beams, substantially as described.

612,351. TROLLEY WHEEL SUPPORT; E. Lane, of Johnstown, Pa. App.



No. 612,146.—ELECTRIC SYSTEM OF DISTRIBUTION.

filed June 28, 1897. In a trolley support, a pair of frames having parallel side bars, guides positioned beyond the side pieces thereof, means for pivotally attaching the lower ends of the frames to the opposite ends of a car, in combination with sliding frames having side pieces, the lower portions of which are parallel, said parallel portions engaging the guides on the frames attached to the car, the upper portion of the side bars of the sliding frames being spread, a transverse connecting bar positioned at the apex of the sliding frames, a trolley wheel mounted on said bar and springs for projecting upward the sliding frames, the parts being assembled substantially as described.